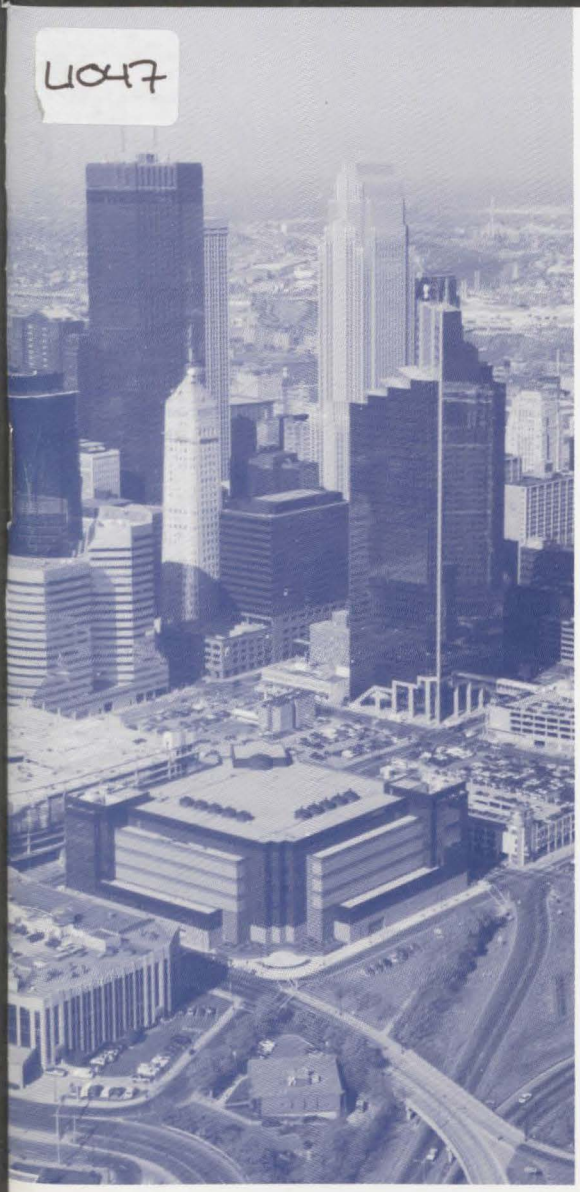
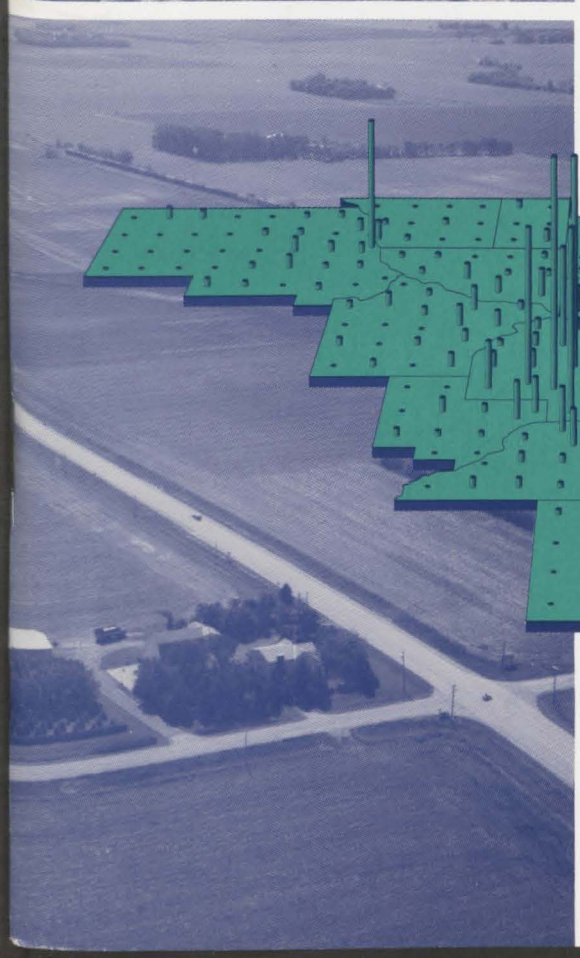


Real Property Value in the Heart of the Upper Midwest

by John R. Borchert
and William Casey



A publication of the Center for Urban and Regional Affairs, 330 Hubert H. Humphrey Center, 301 19th Avenue S., Minneapolis, MN 55455.

1994

Publication No. CURA 94-2

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Preface

The changing value of structures and land reflects the commitment of individuals and communities to the places they inhabit. When people build things, they literally put down their roots in the land. They create not only the real property assets in the economy but also the substance of the world's changing human geography. They create places, the routes that connect places, and the systems of routes and places that make regions.

This relationship between real property value and geography stimulated a geography seminar at the University of Minnesota in 1989-90 to examine the current quality, coverage, and some implications of property value data. The metropolitan complex of eastern Minnesota and western Wisconsin was used as a laboratory. The task turned out to be both protracted and provocative, and this report summarizes our findings.

We sincerely appreciate the financial support of the University of Minnesota's Center for Urban and Regional Affairs (CURA) and Northern States Power Company, and we are deeply grateful to the following agencies for sharing their data: the Minnesota Auditor and Department of Transportation, the Minnesota and Wisconsin Departments of Revenue, the Twin Cities Metropolitan Council, and county assessors' offices in the study area.

Special thanks are due William Craig, CURA, for technical and substantive consultation; Judith Weir, CURA, for patient, careful, and creative editing; Miriam Goldfine and David Swenson, CURA, for computer assistance; Jack Byers, University of Minnesota's Geography Department, for compilation of municipal sewer and water data; Alan Willis and Mui Le, of the University of Minnesota's Geography Department Cartographic Laboratory for preparing all the maps and figures; Deb Volkert, Chris Caulfield, and Leonard Peterson of the Minnesota Revenue Department; Tom Jansen of the Wisconsin Revenue Department; Robert Naylor, Demographic Services, Wisconsin Department of Administration; Tom Gillaspy, Minnesota State Demographer; Charles Delisi, Minnesota Department of Transportation; and to Jane Borchert for patient, critical reading of the manuscript and collaboration in many hours of field observation. All photos in this report were taken by Neil Kveberg, and are reproduced here courtesy of the Minnesota Department of Transportation.

Any errors in manipulation or interpretation of the data are the responsibility of the authors, and most likely the senior author.

Chapter 1. A Regional Profile of Real Property Value

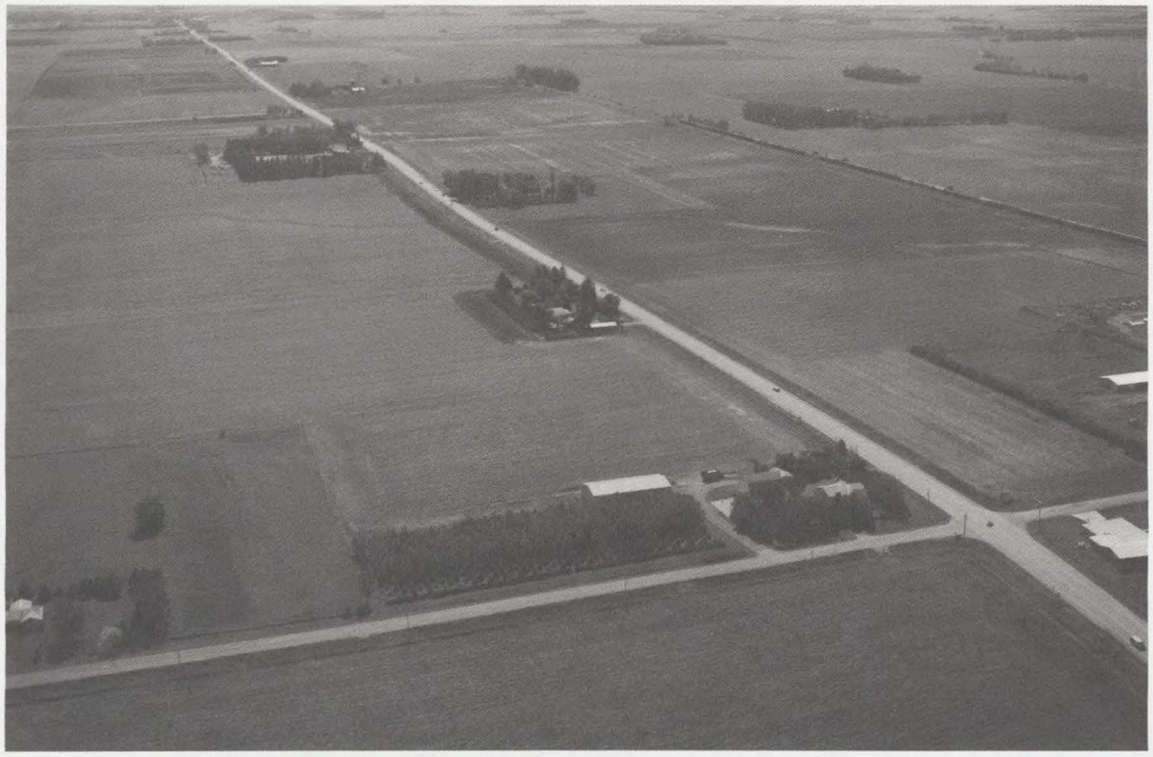
Most of us, most of the time, ignore the built structures in our communities or take them for granted whether they are in use, under construction, or standing in decay. To be sure, land and buildings get our attention in many piecemeal ways. Taxes on property assets are the main internal source of revenue for local governments, so there are often arguments about the assessments of property in the community. Occasionally, structures are the subject of debates, when zoning or preservation become an issue. During planning and construction, each building commands the intense attention of its developers, and it continues to be the object of more or less attention from its occupants. But rarely do most of us contemplate structures and their land collectively as component parts of a vast, fragile device that the human race has built to enable itself to live on the earth.

The value of the structures and land around us has been created by the investment of labor and savings from past and present generations. The investments reflect the pragmatic responses of individuals and communities to their own needs. Consequently, the value of real property assets helps to answer practical questions about management and planning. How much new development is necessary to justify a given level of investment in streets, utilities, or public institutions in the community, the region, or the nation? What is the physical plant of a community worth and what share of the citizens' savings are necessary or justified to create and maintain it? But those investments also reflect dreams and commitments to the futures of places and regions. The location patterns of the accumulated value of structures not only provide a record of practical action but also add to our understanding of the larger purposes of human use of the earth.

Where does one look to find the value of real property assets? The United States Bureau of Economic Analysis produces a highly informative and sophisticated annual estimate of the aggregate net value of all structures in the country.[1] The growth of that value over the years can be related to the national income and savings rates. It can be compared to the output of the manufacturing sector of the economy and to the finance-insurance-real estate sector, to the gross national product, or to other economic and social indicators. The overall estimated value of structures, however, cannot be broken down to specific metropolitan or local levels.[2] The United States Census of Governments collects survey data on assessed value of property for selected metropolitan areas; but coverage is incomplete and not comparable among different areas.[3] In short, we can't describe the parts that comprise the whole.

Meanwhile, down at the local level, assessors' records have the long-run potential for building a national system that can monitor real property values from the individual parcel level upward. Computerization has accelerated the standardizing of valuation procedures and is moving the state and national mass of assessors' market value estimates toward accuracy and comparability. State and local governments in Minnesota and Wisconsin are in the front ranks of

Central Minneapolis had property assets totaling $1.2 billion per square mile in 1988.



Open farmland in Wasioja Township (Dodge County) was valued at $770,000 per square mile in 1988.

this process. These two states also encompass the economic and population core of the nation's Upper Midwest region. Thus, this area is a natural laboratory in which the geographic patterns and change of real property values can be examined in some detail.

The Study Area

The economic heart of Minnesota and of the Upper Midwest region is the combined commuter areas of the Twin Cities, Rochester, and St. Cloud (Figure 1). This twenty-three-county system covers portions of two states and five state planning regions. It contains more than six hundred townships and municipalities (minor civil divisions). Its three million inhabitants equal nearly two-thirds of the population of Minnesota. They number more than one-third of the population of the Twin Cities' primary trade and service area, which sprawls from northwest Wisconsin to eastern Montana, northern Iowa to the Canadian boundary. The estimated value of all of the structures and land in these twenty-three counties in 1988 was $142 billion. At that time, the area had 1.2 percent of the population of the United States, 1.3 percent of the personal income, and 1.4 percent of the real property assets.[4]

Figure 1. The St. Cloud–Twin Cities–Rochester corridor.

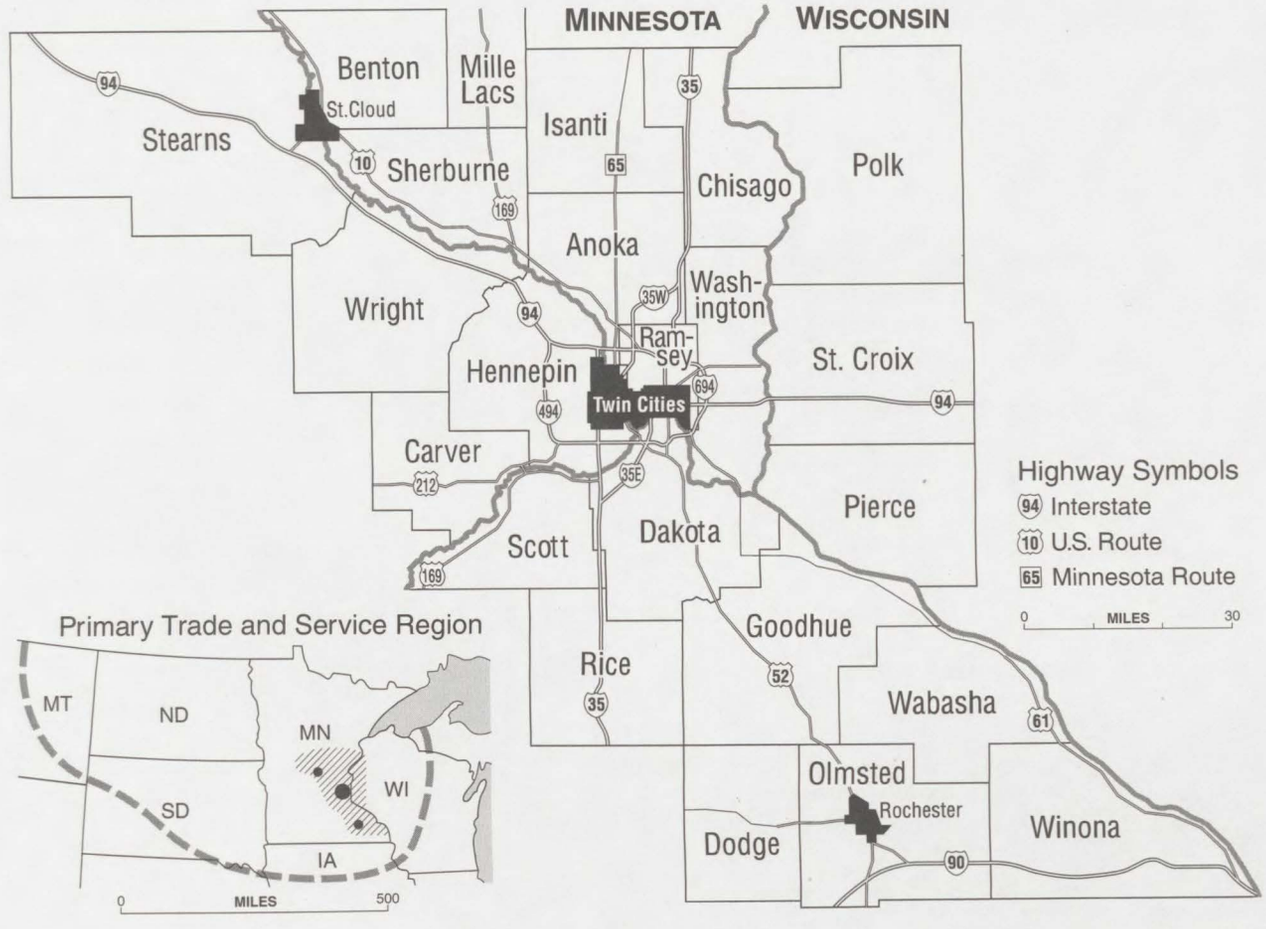
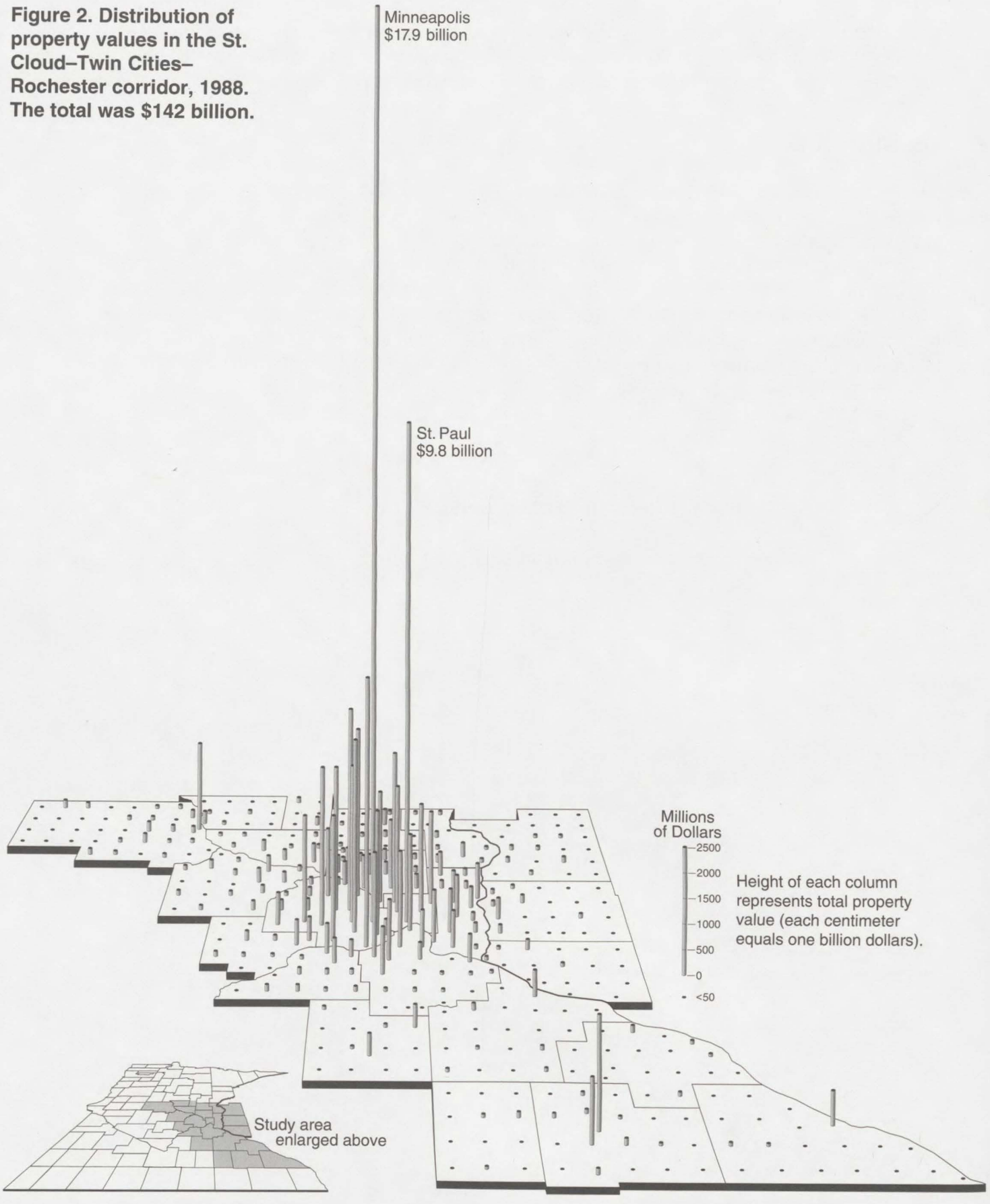


Figure 2. Distribution of property values in the St. Cloud–Twin Cities–Rochester corridor, 1988. The total was $142 billion.



The data we used for mapping property values came from the Minnesota and Wisconsin Departments of Revenue, the Minnesota Department of Transportation, and the Minnesota State Auditor, with help from individual county assessors' offices and the Twin Cities Metropolitan Airports Commission. The numbers include the estimated market values of taxable and tax-exempt properties as determined by the public assessors, together with auditors' estimates of the book value of airports, sewer, and water systems, and our own estimates of the depreciated value of all public streets and roads.[5] All values given here are expressed in constant 1988 dollars; and all are on the conservative side.

The Varying Landscapes of Real Property Value

You can visualize the study area as essentially a vast landscape of accessible land and structures. The $142 billion inventory includes not only buildings of all kinds but also non-building structures—streets, highways, railroads, airports, and all kinds of utility lines—and the land associated with these structures. The structures shelter and interconnect all of the human activities that go on in the area. They are both privately and publicly owned. They are both old and new. Some are newly occupied, others stand on the threshold of abandonment and ruin. The land is either improved or vacant. In either case roads make it accessible and give it value. Here is a stock of assets which residents of the area enlarge, improve, use, wear out, replace, and abandon, in continuing cycles of building and development.

You can further visualize all of this value as a layer of property wealth spread over the earth's surface. Suppose the surface of the property wealth layer were a big, undulating, transparent sheet, supported by columns rising from the visible ground below—one column from each of the six hundred and more minor civil divisions (MCDs). The columns would have different heights, reflecting the total value of real property in each MCD. A map of the columns would resemble Figure 2. The imaginary value surface that these columns determine is a way of reading the geography of the area—a terrain of work, dreams and power manifested in real property value laid on top of the land. Furthermore, as we will see in some detail in Chapter 3, the surface gradually rises with the growing population and economy; while, at the same time, it undulates with changing technology, style, and speculation.

Contrasts Among the Development Density Classes

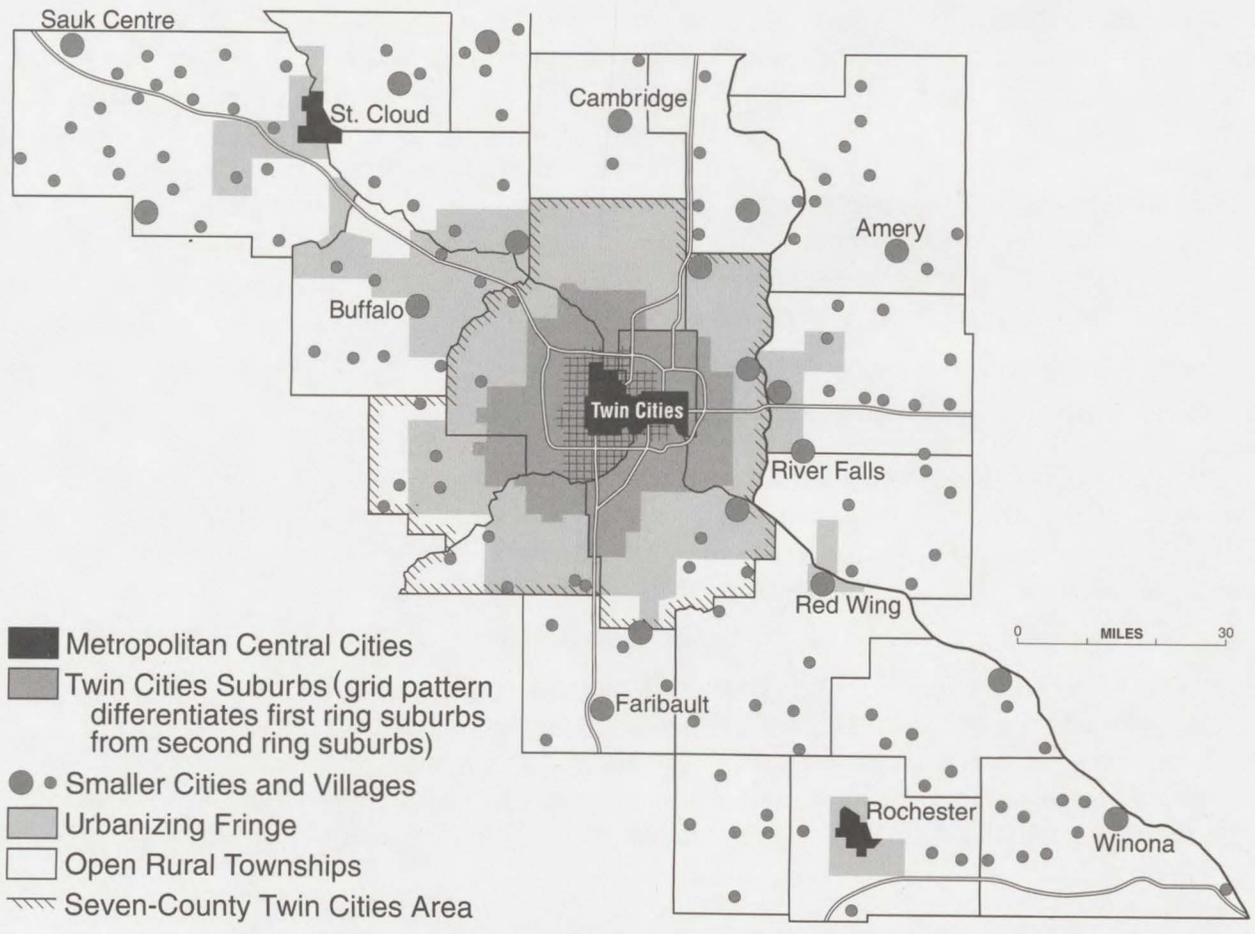
To help grasp the geographical variations in property value, we placed each of the six hundred-odd minor civil divisions into one of five classes, based on the density of property values per square mile. The geographic patterns of the five classes are shown in Figure 3. The classes are a useful way to summarize the thousands of MCD values in our data:

1. The *metropolitan central cities* are Minneapolis and St. Paul, St. Cloud, and Rochester.
2. The *Twin Cities suburbs* include both a first and second ring. The first ring extends northwest from Roseville to Brooklyn Center; southward to Edina, Richfield, and Bloomington, and includes West St. Paul. The second ring extends west from South St. Paul and Inver Grove Heights, through Shakopee; north through the Lake Minnetonka suburbs to Anoka; then curves east through Blaine and White Bear; and south to Woodbury.[6]

3. Embedded in the landscape are the *smaller cities and villages*. These are older communities inherited from the railroad settlement era. They developed as farm trade centers in the rail era and they range in size from Winona and Faribault, through Amery and Cambridge, down to the unlabelled hamlets that mark the routes of all the rail lines.
4. Beyond the rings of Twin Cities suburbs we identified an *urbanizing fringe*. It includes not only the moderately-dense to scattered settlements of the outer suburbs of the Twin Cities but also similar urbanizing townships on the fringes of St. Cloud, Rochester, and Red Wing as well as the freeway and lakeshore development corridor from the Twin Cities northwestward through northern Wright and southern Sherburne counties.
5. The remainder of the townships fall into an *open rural* class.

The metropolitan central cities, first and second ring suburbs, and urbanizing fringes in 1988 were the locus of $118 billion in real property value—83 percent of the study area total, with an almost identical percentage of the population (Figure 4). The smaller compact cities—including both the seven-county Twin Cities area's free-standing centers and places in the

Figure 3. Classes of development density based on property values per square mile in 1988.



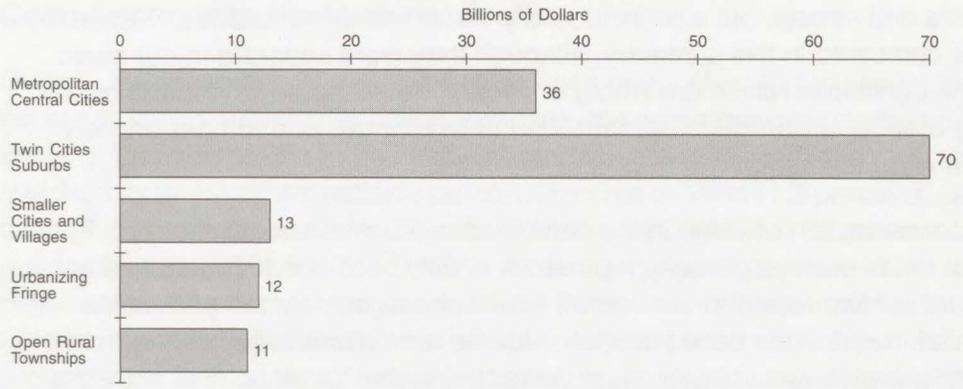


Figure 4. Real property assets by development density classes, 1988.

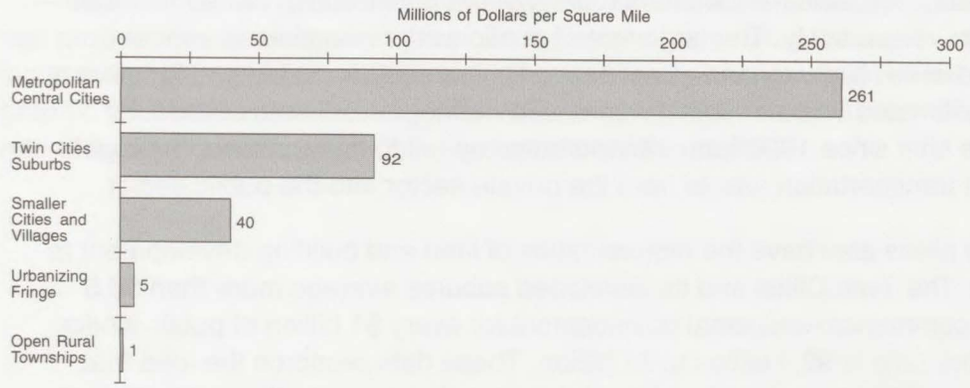


Figure 5. Assets per square mile by development density classes, 1988.

outlying counties—accounted for $13 billion or 9 percent of the area's property wealth. The remaining 8 percent, or $11 billion, were spread across the predominantly agricultural rural townships, although even there exurban non-farm homes and businesses accounted for a quarter to half of the values.

The geographic concentration of property assets is clearest when it is shown as the density of real property assets per square mile (Figure 5). Ratios ranged from a quarter-billion dollars a square mile in the central cities down to a million dollars in the rural townships. The central cities values per square mile were nearly three times as high as those in the suburban rings—the result of historically very high densities of residential and industrial development in the older cities, together with continuing intense commercial development there. Familiar and strikingly different landscapes reflect the range of investment per square mile (see photos).

Contrasts Among the Land Use Classes

Figure 6 shows the distribution of property values among major classes of land use. The commerical–industrial class includes not only the full range of retail, office, and industrial buildings but also the taxable, privately-owned electrical utility, communications, and railroad land and buildings. The tax-exempt category includes both government and non-government property such as schools, civic centers, churches, hospitals, and cemeteries. The public works

structures are mainly roads and streets, but also include city water and sewer utilities. Vacant and agricultural lands are combined in this summary, although they were separate in our basic data. Assets in the vacant–agricultural class are wholly in vacant, developable land in the cities and suburbs, mostly in potential urban development land in the fringe, and almost entirely in agricultural land in the rural townships.

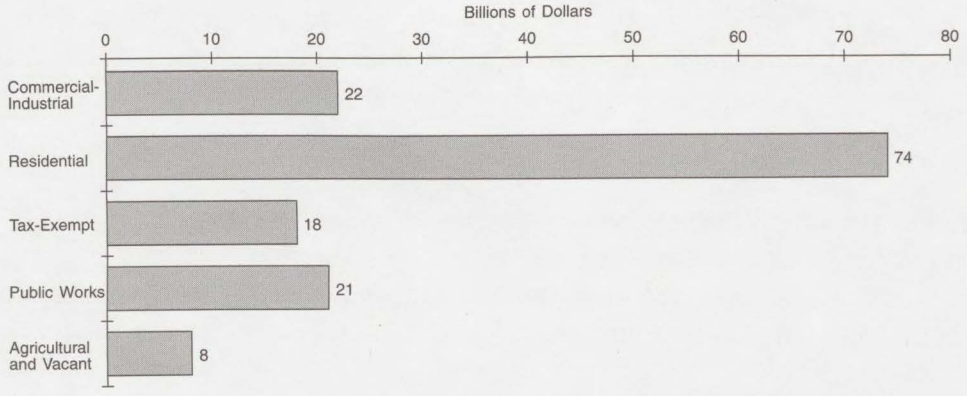
Most striking is the concentration of value in the combined residential and tax exempt properties. The $18 billion in tax-exempt property represents mainly buildings to house educational, health, religious, and public protection services. It also includes cemeteries and parks. The $74 billion in residential investments provides shelter for the area's one million households. Hence, four-fifths of the total investment in buildings is dedicated to the "quality of life" activities of home and community.[7]

Investments in private commerical–industrial properties and public works are about equal—$22 billion and $21 billion, respectively. The large role of public works is explained almost entirely by the high value of the highway and street network. That system accounted for more than nine-tenths of the estimated value of public works, and nearly one-seventh of the total value of all property. The shift since 1920 from transportation by rail to transportation by highway and air moved most transportation assets from the private sector into the public sector.

The highest density areas also have the highest ratios of land and building development to public works investment. The Twin Cities and its developed suburbs average more than $6.5 billion of residential and commerical–industrial development for every $1 billion of public works. In the urbanizing fringe the ratio is $2.4 billion to $1 billion. These data reinforce the idea that, given today's technology, public works investments in high-density areas are the most efficient, while investment in low-density non-farm areas is a relative luxury.

Figure 7, which combines Figures 4 and 6, provides another view of the variety of landscapes generated by the historic and geographic process of development. Here MCDs have been aggregated into the land and density classes already described.

Figure 6. Real property assets by land use classes, 1988.



Comparison with the National Profile

Overall, the proportion of development in each major class in the twenty-three-county area that we are studying is similar to national profiles, but with significant deviation.[8] The Twin Cities' share of the national estimated value of structures and related land (1.4 percent) roughly matched its share of the nation's personal income in 1988 (1.3 percent). Government and tax-exempt property accounts for 27 percent of the total here and 30 percent nationwide. But residential property value accounts for a considerably larger share of the total here than nationwide—52 percent compared with 47 percent. And the commerical–industrial share of Twin Cities property is significantly less—15 percent compared with 23 percent. Those differences probably are at least partly explained by the higher investment in heavy industry in some other parts of the nation.[9]

The national comparisons, then, suggest that there are probably variations in the level of real property investment among various regions of the country, based on differences in both income and the mix of local industries. Meanwhile, there is no doubt about the very large geographic variations within the larger Twin Cities area of our study. These differences reflect the role of location and history in the development of the region.

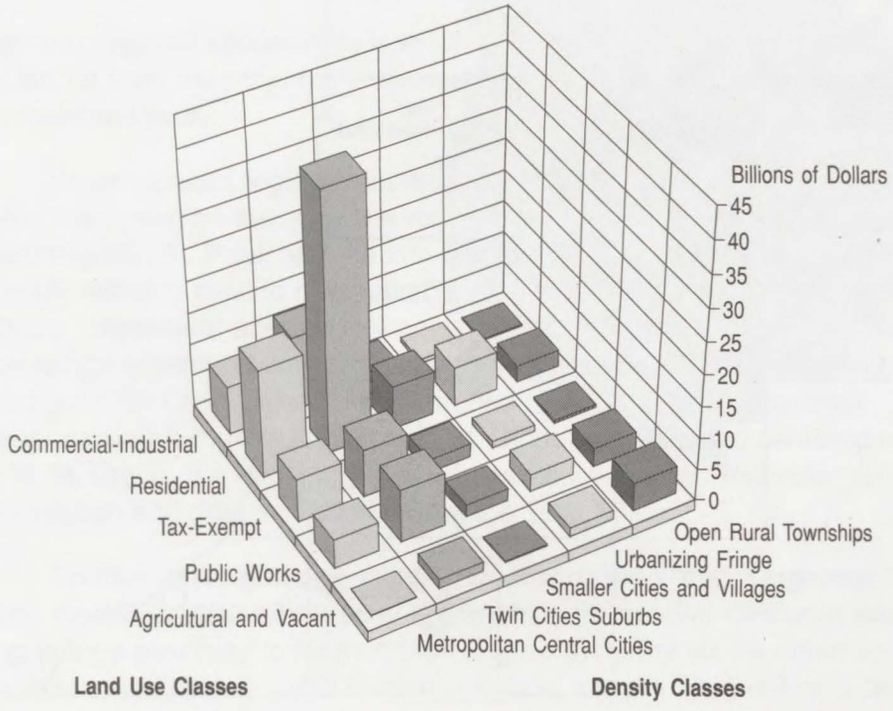


Figure 7. Real property assets by land use and development density classes, 1988.

Chapter 2. How Location and Legacy Shape Property Value

Location creates value. The location of a place is relative to the location of other places, and the value of that location depends upon the ease of reaching it from other places—its accessibility. Hence another word for location is accessibility.

In the St. Cloud–Twin Cities–Rochester corridor, we have used two measures of accessibility to describe the location of the different classes of real property value: "general regional accessibility" and "highway proximity." The general regional accessibility of a place depends on the distance from it to each of the other six hundred and more places in the study area and on the population of each of these other places. For example, Golden Valley is much closer to most of the other more populous places than is similar-sized Winona. Thus Golden Valley's

Figure 8. General regional accessibility.

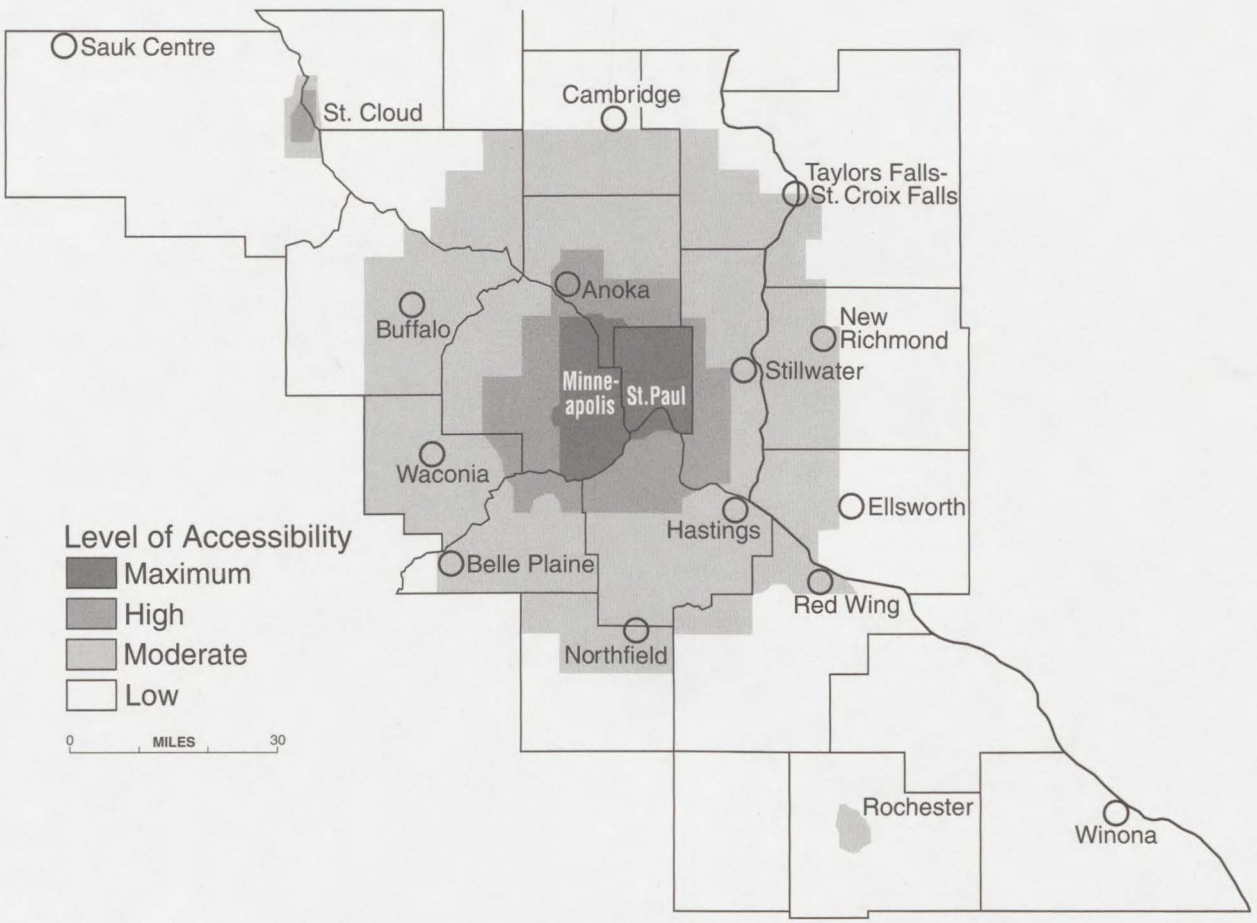
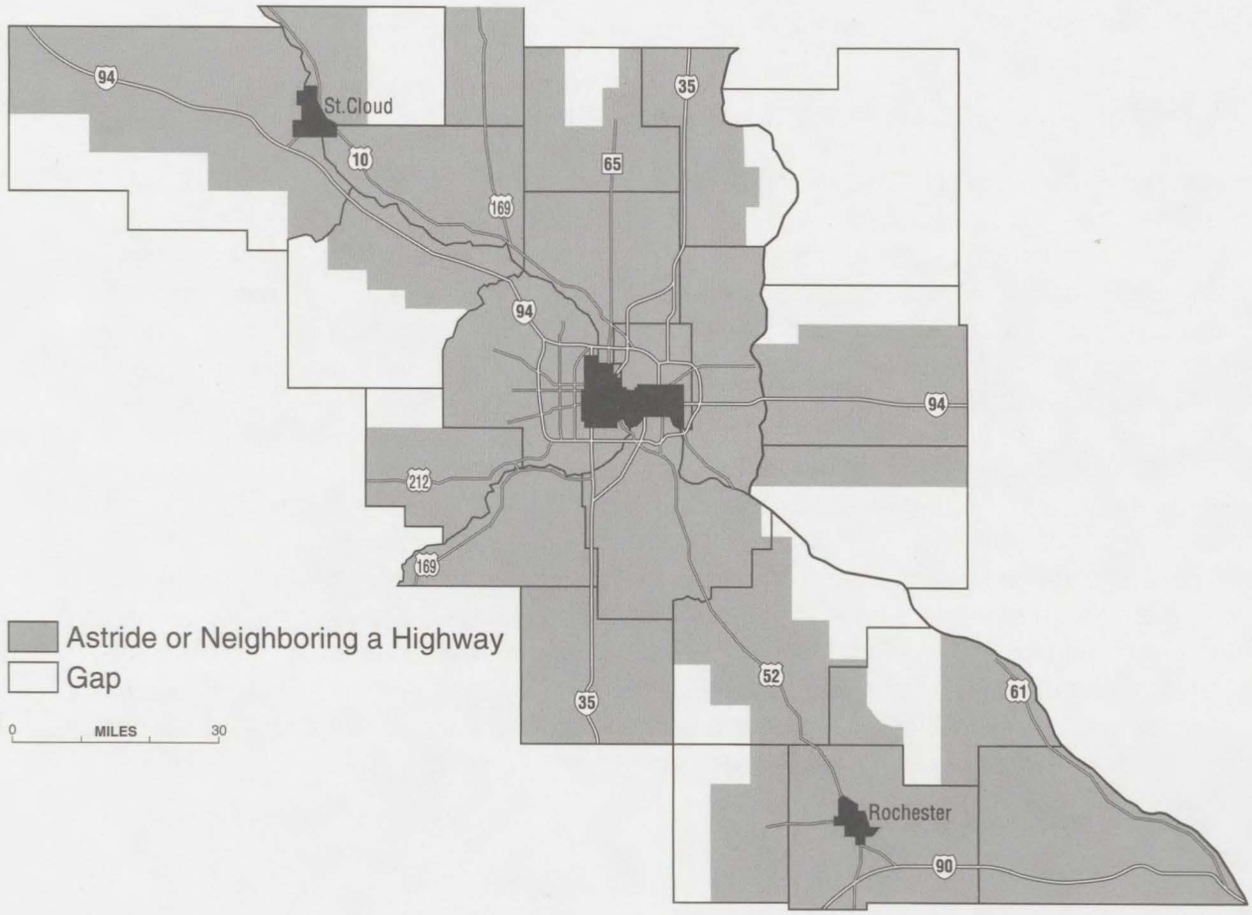


Figure 9. Proximity to major highways.



general regional accessibility is much higher. St. Cloud is much larger than Golden Valley, but it is farther from the main regional mass of population, hence its general regional accessibility is somewhat lower.[1]

When general regional accessibility is calculated for each place, and lines of equal accessibility are drawn on the map, the result is the pattern in Figure 8. the "maximum" class covers Minneapolis, St. Paul, and the first ring suburbs. The "high" accessibility area coincides approximately with the second ring suburbs, and an outlying island of high access is centered on St. Cloud. "Moderate" accessibility covers the urbanizing fringe of the Twin Cities and a ring of townships extending outward beyond Waconia and Buffalo to roughly Cambridge and Northfield and on to St. Croix Falls, New Richmond and Ellsworth in Wisconsin. The "moderate" zone reappears as a narrow ring around St. Cloud and an island centered on Rochester. Compared with St. Cloud, the lower regional accessibility value for Rochester reflects its slightly smaller population and greater distance from the Twin Cities.

To measure highway proximity, we first defined "major highways" as divided and multiple-lane roadways. Municipalities and townships (minor civil divisions) were then classified according to their proximity to those routes (Figure 9). Many MCDs either lie astride one of those routes, or neighbor an MCD which is astride a route. They define a set of corridors. For the

most part, these corridors follow familiar main highways radiating from the Twin Cities. The remaining MCDs lie in gaps between the corridors. Experimentation with the data focused our analysis on the two levels of highway proximity shown in Figure 9.

Development and Location at the Regional Scale

The system of settlement is interactive and interdependent. It is evident from Figure 10 that building investment has been concentrated in the most accessible locations. Conversely, investment in roads and streets has been greatest in the locations with the highest concentrations of buildings. High accessibility has encouraged investment in buildings, and high investment in buildings has encouraged investment in transportation. Measured in value per square mile, the density of investment is 130 times as high in the maximum accessibility zone as it is in the outer zone of low accessibility (Figure 11).

Accessibility had one meaning in the railway age, up to about 1920, and has had quite a different meaning in the auto-airplane age, since 1920. Before the 1920s virtually all movement of people and goods between cities depended on railroads. Therefore, the growth of most villages and all cities emanated from the railroad station. Local movement to and from the station depended on streetcar (in the larger cities), wagon, and foot. Growth crowded as near as possible to the railroad station. Factories and warehouses depended completely on the railroad for linkage to their distant markets and raw materials, but they also needed a local labor force, so they located along the railroad line but also crowded as near as possible to the center of the city. The result was more compact and higher density development than we know today.

Figure 10. Real property assets by classes of general regional accessibility, 1988. (Values do not include public works.)

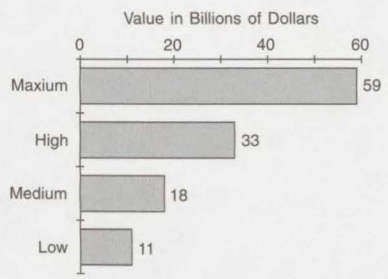
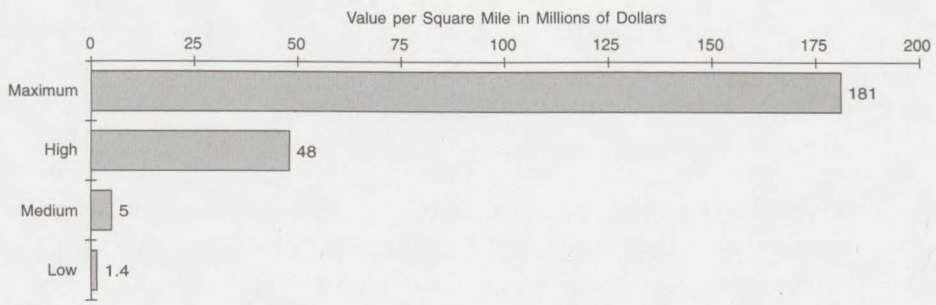


Figure 11. Real property assets per square mile by classes of general regional accessibility, 1988. (Values do not include public works.)

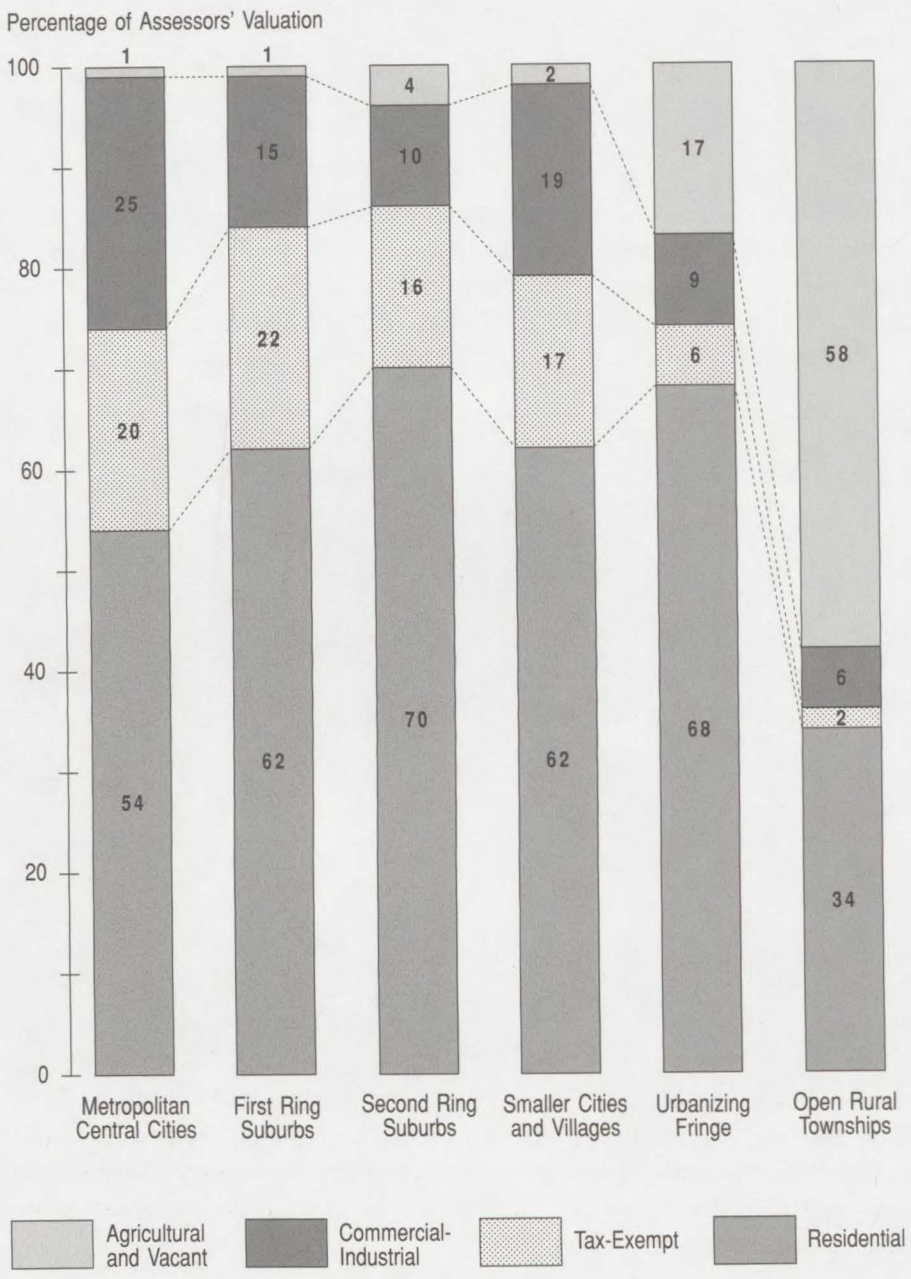


In densely-developed St. Paul, land in the foreground was valued at $140 million per square mile in 1988, while land was worth $860 million per square mile in the distant central area of the city. This high-density mix of different land uses is typical of compact, rail-era cities.

Dodge Center, a compact small city, was valued at $24 million per square mile in 1988. Though far different in scale and intensity of development, it shares with St. Paul the mix of different land uses in close proximity that is typical of compact, rail-era cities.

Though inexorable, the change from the railway era has been gradual. We find that the mix of land uses in different types of settlement still reflects the past. For example, compared with the suburbs and the urbanizing fringe, the metropolitan central cities have large shares of their property value in high-density commercial and industrial development (Figure 12). The land use mix in the smaller cities and villages (both in the Twin Cities seven-county area and in the outlying counties) closely resembles the metropolitan central cities. The pattern of development and the land-use mix of all of these places is a legacy from the rail era (see photos). They were the most accessible locations on the rail network. Their high densities and mix of development reflect the constraints of horse-drawn, streetcar, and pedestrian movement.

Figure 12. Land use mix in different development density classes, 1988.



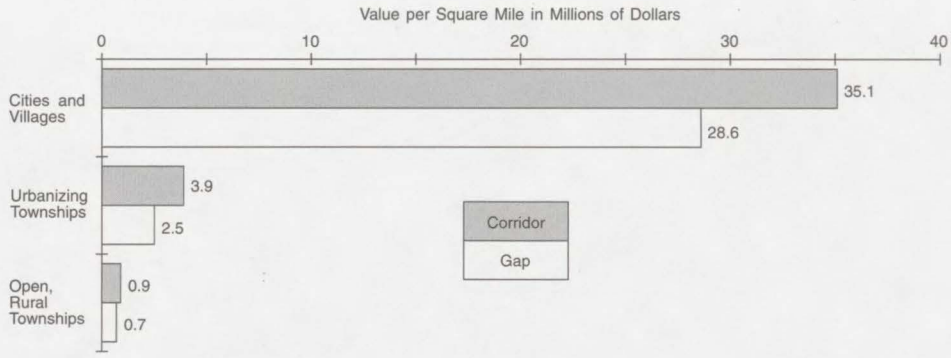
Scattered development in Eagan was valued at $58 million per square mile in 1988. Residential structures dominate in this second ring suburb, but commercial and industrial development will inexorably follow. Eagan's higher value when compared with Dodge Center reflects its higher general regional accessibility and newer structures.

There is an overriding reason why the response to change has been gradual. Structures have long lives—on the average, more than a century. Hence, growth tends to be incremental, in and around places that already exist. Each generation has added structures to accommodate its own growth in numbers and wealth. Yet no generation can afford to replace more than a small percent of the billions of dollars worth of structures it inherits in any decade. So each generation must also continue to use most of its legacy of buildings and other structures from earlier times.

In line with this tendency, investment in the regional highway system has partly reinforced the historic rail pattern. New roads serve the older rail-era cities. As a result, the location and land-use patterns of the rail-era cities, both large and small, are partly anachronistic. Because of the long life of structures, the change from settlement patterns of the rail age to those of the automobile and airplane age is evolving only gradually over several generations. For the most part, the bigger the city, the greater its inertia; and, of course, anything that increases the life expectancy of structures also increases the inertia.

While auto-era growth has continued to concentrate investment around the historic metropolitan nodes, it has gradually spread out in successively widening suburban rings. Figure 12 suggests that residential investment has led the outward march. Residential property comprises only a little more than half the total value in the metropolitan central cities, but it rises to more than 60 percent in the first ring suburbs and more than two-thirds in the second ring and in the urbanizing fringe.

Figure 13. Value per square mile in highway corridors compared with value per square mile in intervening gaps, 1988. (See Figure 9 for highway corridor locations.)



At the same time, the share of non-residential property value in the suburbs and urbanizing fringe also appears to be rising. Tax-exempt and commerical–industrial uses account for only a little more than one-tenth of all value in the urbanizing fringe; yet they have grown to comprise about one-fourth of the total in the second ring suburbs, and more than one-third of the total in the first ring. Thus, it appears that business development and tax-exempt schools, churches, and other institutions have followed the outward march, as residential expansion has created new markets and needs. The landscape in Eagan (see photo) typifies this process of succession.

Beyond the suburban rings, urbanization has reached out farther and faster in the highway corridors than in the intervening gaps (Figure 13). In the cities and villages within the corridors, investment has been 23 percent higher than in comparable places in the gaps, in the urbanizing townships 56 percent higher, and in the rural townships 29 percent higher. But the freeway effects have not been simple and straightforward. Public decisions on freeway timing and location were constrained by the settlement pattern already in place when they were planned. Conversely, the freeways have also influenced the direction of new growth. Development investment has naturally favored highway proximity, though widely dispersed lake shores and cultural community ties have prevented any landslide toward the freeways.

Location (and Site) within Minneapolis–St. Paul and the Near Suburbs

With more than one-quarter of the value per square mile on only 4 percent of the land, Minneapolis and St. Paul are at the peak of the property value map in our study area. They were valued at more than $260 million per square mile in 1988 though at closer observation, of course, we see that values vary greatly within the cities. The map in Figure 14 outlines the one-mile-square sections that make up the central district (C) of each city,[2] along with the four historic directions of growth around each center. The map also shows the belts of railroad trackage and industrial development and the principal lakes. Figure 15 presents the average property value per square mile in each of these ten sectors in the central cities in 1988.

The central districts attracted the highest level of investment when they were the nexus of the regional rail network, and they have continued to be the focus of subsequent high levels of rebuilding and expansion. From the beginning, market forces have been reinforced by public decisions, whether it was in locating the state capitol and county seats or in actions of the city economic development authorities after the Second World War—decisions about urban renewal, public housing, TIF zones, and university expansion, for example. Property values averaged nearly $1.2 billion per square mile in central Minneapolis in 1988, more than half in commercial values and one-fourth in tax-exempt institutional buildings. Comparable figures in central St. Paul were more than $860 million, with about 43 percent commercial and 42 percent tax-exempt. The numbers reflect mainly the greater office and retail development of central Minneapolis and the state capitol complex in St. Paul.

The main rail-industry corridor ran through the cities from north Minneapolis to South St. Paul. Within the corridor and northeast of it, much of the development was divided from downtown by the rail lines. Industries brought the most widespread blight to this area, and its historic separation from the rest of the city is still visible. Overall property values, for example, are somewhat higher in the southwest quadrant of each city than they are in the northeast of Minneapolis and the northwest of St. Paul.

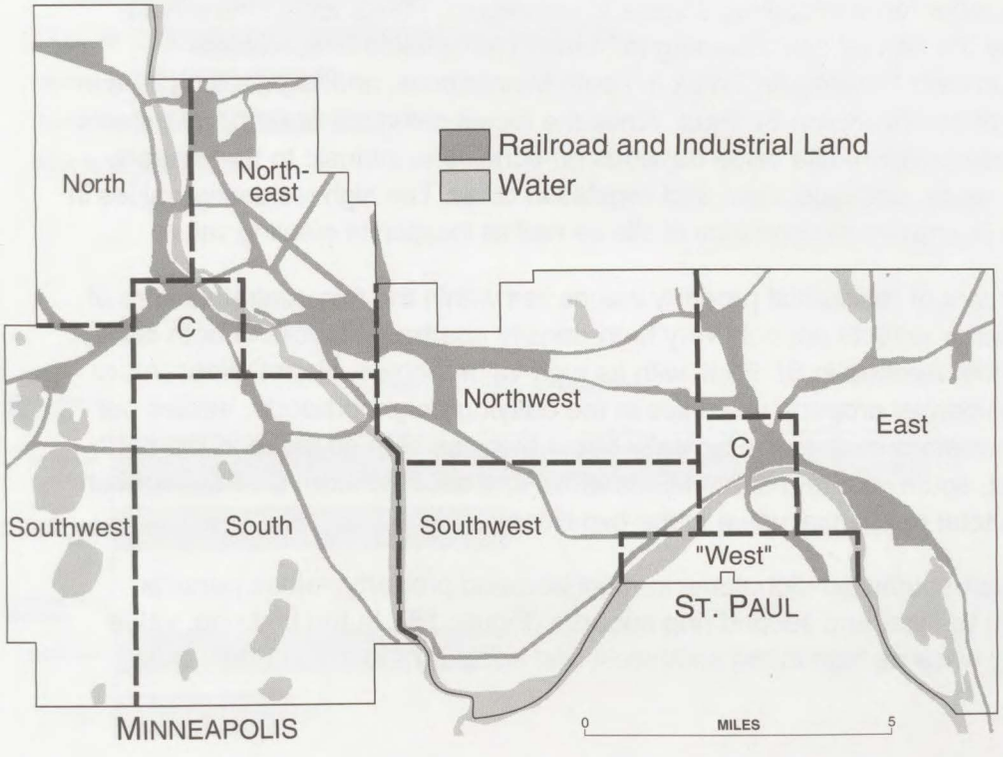


Figure 14. Sectors of the Twin Cities, based on historic development patterns.

Figure 15. Property values per square mile in the historic development sectors of the Twin Cities, 1988. (See Figure 14 for a map of the sectors. Values do not include public works.)

Differences are more striking if you look specifically at commercial and industrial properties (Figure 16). Concentration in the central sector is profound, with 54 percent of the total for both cities in central Minneapolis, and 33 percent in central St. Paul. Although the remaining 13 percent of non-residential value is spread among many locations throughout both cities, almost half of it is concentrated in Northeast Minneapolis and the Midway district of St. Paul (the northwest quadrant).

The highest residential values in the Twin Cities neighborhoods are southwest of both downtowns, as well as in the far southern quadrant of Minneapolis (Figure 17). During the growth of the cities, these were the directions that offered the fewest barriers for the burgeoning "white-collar" commuter labor force in gaining access to downtown. These locational advantages were reinforced by the natural site advantages of river bluffs, lakes in southwest Minneapolis, rolling lands near Minnehaha Creek in south Minneapolis, and high, rolling land in the Highland Park area of southwestern St. Paul. While the locational value of property reflects its accessibility in the wider system, site value depends on conditions intrinsic to the property itself—notably elevation, slope, drainage, view, and vegetation cover. The high residential values in the southwest quadrants illustrate the importance of site as well as location in creating value.

A surprising 31 percent of residential property values lies within the two central sectors of the Twin Cities. The number reflects not only very high-density apartment blocks in both cities, but also portions of Summit Avenue in St. Paul, with its high-value homes. Nonetheless, more than two-thirds of the residential property value lies in the outlying neighborhoods. Values per square mile in the southwestern sectors are typically about twice as high as those in the northeast or northwest. In fact, southwest and south Minneapolis and southwestern St. Paul contain nearly 40 percent of the total residential value in the two cities.

The historic northeast-southwest dichotomy in neighborhood property values persists beyond Minneapolis, into the first and second ring suburbs (Figure 18). In the first ring, value per square mile is nearly twice as high in the southwest and south as it is in the north and

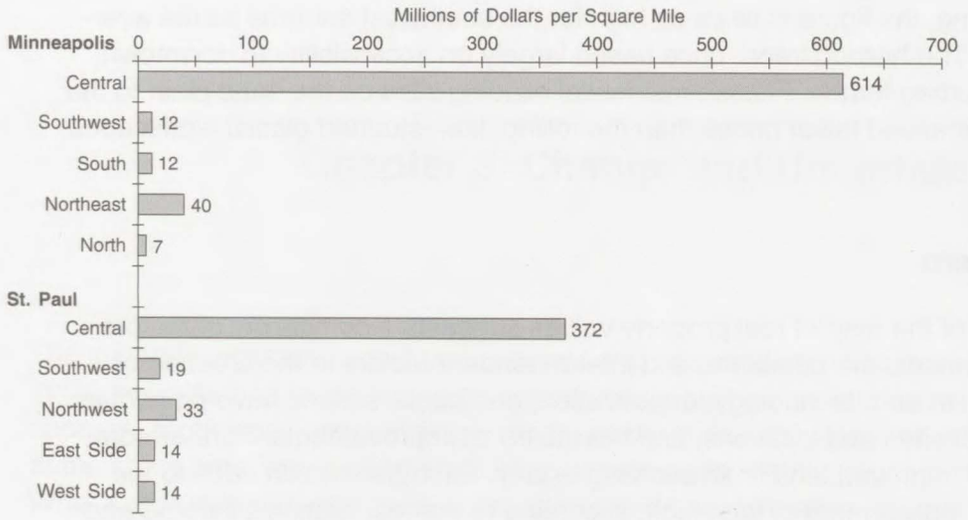


Figure 16. Commercial–industrial property values per square mile in the historic development sectors of the Twin Cities, 1988. (See Figure 14 for a map of the sectors.)

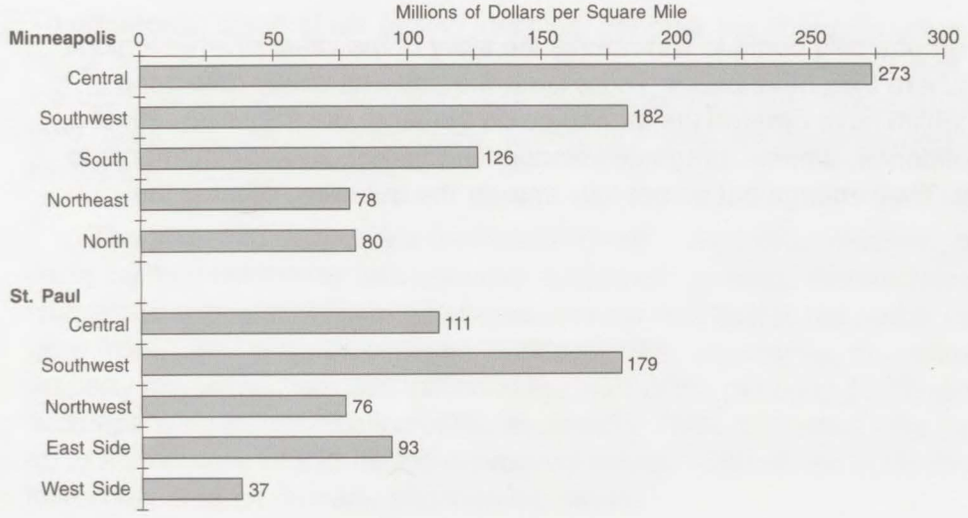


Figure 17. Residential property values per square mile in the historic development sectors of the Twin Cities, 1988. (See Figure 14 for a map of the sectors.)

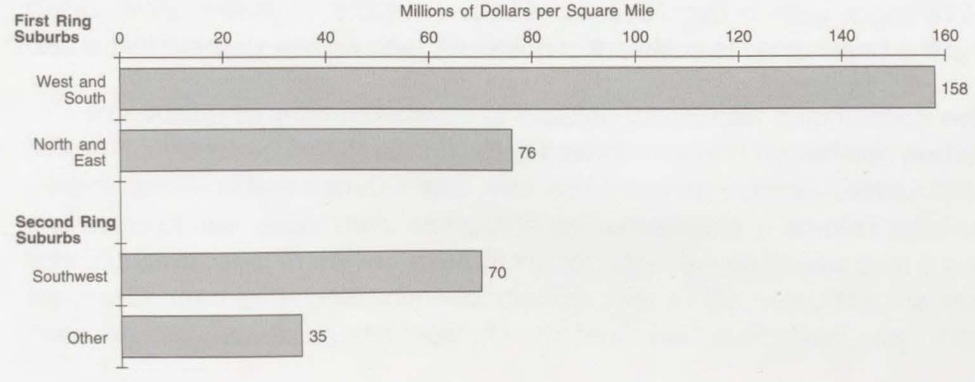


Figure 18. Property values per square mile in the suburbs of Minneapolis, 1988. (Values do not include public works.)

northeast. In the second ring, the figure is twice as high for the southwest suburbs as the average for all of the others.[3] The historic trend, once based largely on accessibility to downtown, was reinforced by the suburban terrain. Flattish residential building sites on the sand plain to the north, have generally commanded lower prices than the rolling, lake-studded glacial landscapes to the south and west.

Complexity of the Pattern

Even a brief interpretation of the map of real property values suggests a complexity of factors. Site, location, and improvements are combined and interdependent factors in the creation of sharply contrasting values. In turn, technology, organization, and public actions have powerfully influenced the evaluation of sites and locations, and the quality of improvements. Furthermore, the stock of structures and improved land is an evolving legacy. Each generation adds to the accumulation and gradual replacement of the stock, according to that generation's income and its allocation of savings to the development process. The broad patterns of property value noted here are the sum of hundreds of thousands of location and development decisions by private and public organizations and by individuals who have built on more than a million separate ownership parcels of land.

These few maps and graphs only begin to summarize the story of the value of what legions of builders have built, and where they have built it. To be sure, the patterns subtly reflect the market and cultural forces which have ordered the structures on the land. But they also reflect a fascinating amalgam of confidence, dreams, pragmatic responses to need, and commitments to the future of the community. They enlarge but do not fully answer the question, What is the region really worth?

Chapter 3. Change and Uncertainty

The cultural landscape is part of a constant and unavoidable process of change. The value of structures attached to the land and improvements built on the land is not nearly as static as it appears. Each week new buildings, roads, power lines, and pipes are added to the system; but at the same time, the existing stock of structures ages slightly, slipping imperceptibly in value. What appears in principle to be a straightforward transformation actually involves shifts of value that are multi-faceted in their complexity and often puzzling in their detail.

Changing Values in One Community

To appreciate some of the factors involved, consider the changing value over time of a single minor civil division (MCD), the smallest level for which we collected data. Visualize a township in the urbanizing fringe of the Twin Cities commuting area (see Figure 3). Its location is thirty to forty miles from the two downtowns, twenty to twenty-five miles beyond the freeway corridor that circles the metropolitan area.

The township boundaries enclose thirty-six square miles of rolling, glacial land. The land is partly built up but mostly field, pasture, and woods, among scattered lakes and wetlands. Numerous arterial highways crisscross the area and tie it to the rest of the region. Its population grew from 1,500 to 2,500 between 1975 and 1988. Meanwhile, the estimated value of its real property increased from $56 million at the start of the period to $129 million at its close—with an accompanying transformation of the landscape. Table 1 illustrates the main changes that added up to an increase of $73 million in property values—$60 million in taxable property and $13 million tax-exempt property and in public works.[1]

The value of virtually all property in the township increased because of the growth of the Twin Cities metropolitan area. This single township was part of a bigger and richer market in 1988 than it had been in 1975. Because of outward expansion, it was effectively nearer the main metropolis than it had been. We refer to the value added by the size and proximity of the metropolitan market as "location value." Increased location value added $17 million to the value of residential property and another $9 million to the value of vacant land in this particular township.

In addition to growth because of location value, new construction added just over $50 million. Contractors built three hundred new homes and remodeled perhaps thirty old ones. Commercial builders added a strip mall and other new stores, restaurants, a self-storage center, and miles of new utility lines, along with the remodeling of an old creamery and lumber yard for light industrial use. In the tax-exempt sector, local governments built a new community center, fire station, and additional schoolrooms. Besides all the newly taxable structures—and partly because of them—state and local governments built and rebuilt more than forty miles of roads.

Table 1. How Property Value Changed in One Urbanizing Township, 1975-1988*

	Residential	Agricultural-Vacant	Commercial-Industrial	Tax-Exempt	Public Works	Total
Property Value in 1975	30	12	1	5	8	56
Increases in Location Value	17	9	0.3			26.3
New Building and Remodeling	32		1.8	2.5	14	50.3
Decreases from Deterioration	-2	-1	-0.1	-0.5	-4	-7.6
Changes Due to Land Transfers		-1		1		0
Increases in Crop Land Value		4				4
Property Value in 1988	77	23	3	8	18	129
Net Change 1975-1988	+47	+11	+2	+3	+10	+73

* In millions of 1988 dollars.

On the other hand, other changes partly offset these gains. More than $7 million in value disappeared as a result of depreciation. Some old homes suffered from age, obsolescence, and neglect. Many farm outbuildings, no longer needed, fell into ruins. An ill-conceived cluster of seasonal cottages fell victim to mysteriously rising lake levels. A few commercial properties lost value—not only due to age and physical obsolescence, but also because a new highway by-passed them. Some agricultural and vacant land shifted from private ownership to public. Storm damage and vandalism took a small toll. Despite the widespread collapse of farmland value following the speculative boom in the 1970s, agricultural and vacant land in this township showed a net gain because of the potential for urban development.

The township we describe is a hypothetical composite, and it is only a very small part of the twenty-three-county study area. But it illustrates the provocative questions and uncertainties we face in describing and interpreting property value changes. How do the experiences in this township compare with other places across the region and across the United States? How much of the increase in value results from new construction? How much reflects a general increase in location value? And how much of the gain was offset by deterioration and abandonment? What are the effects of style, technology, and construction standards on changes in market value? What is the relation of changes in market value to fluctuations in income, credit, and sources of financing? How do property value changes reflect the use of property: the number of people and households; business employment and revenue; and the public use of tax-exempt properties, roads, and other public improvements? How accurate are the measures of change in market value?

Though the ratios of assessed values to sales values indicate a high and improving level of accuracy, they are still uneven both historically and geographically. What is the value of tax-exempt property and public works which are not on the market? To be sure, their costs, combined with assumed depreciation schedules, provide current values, but can the many different

depreciation assumptions be coordinated to make the value estimates for public property compatible with those for marketable property? How are these data for hundreds of townships and municipalities to be collated, summarized, and made historically comparable? These questions will surface again in this examination of property value changes for the region.

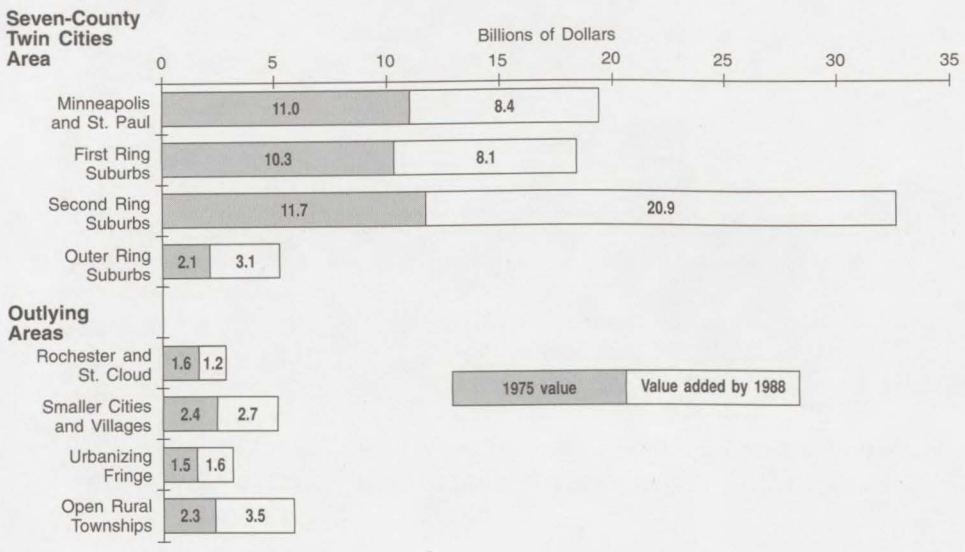
Recent structures overshadow the pre-1970 skyline of central Minneapolis. Anticipated growth in property value has temporarily exceeded the actual growth of market values in the central city area.

Changing Value in the Twenty-Three-County Area

The $60 million growth in taxable property value in the township we just described accounted for little more than one one-thousandth of the increase for the entire Rochester–Twin Cities–St. Cloud corridor. An impressive $49.5 billion was added between 1975 and 1988 in this twenty-three-county area (Figure 19).[2] The thirteen-year increase exceeded the entire accumulated value up to 1975. More than four-fifths of the growth—$40 billion—was concentrated in the seven-county Twin Cities metropolitan area. Thus the share of property assets in the region's core area continued its 125-year rise. The dominance of value in the residential category persisted (Figure 20). Residential assets accounted for three-fourths of the total value in 1975 and three-fourths of the 1975-88 growth as well.

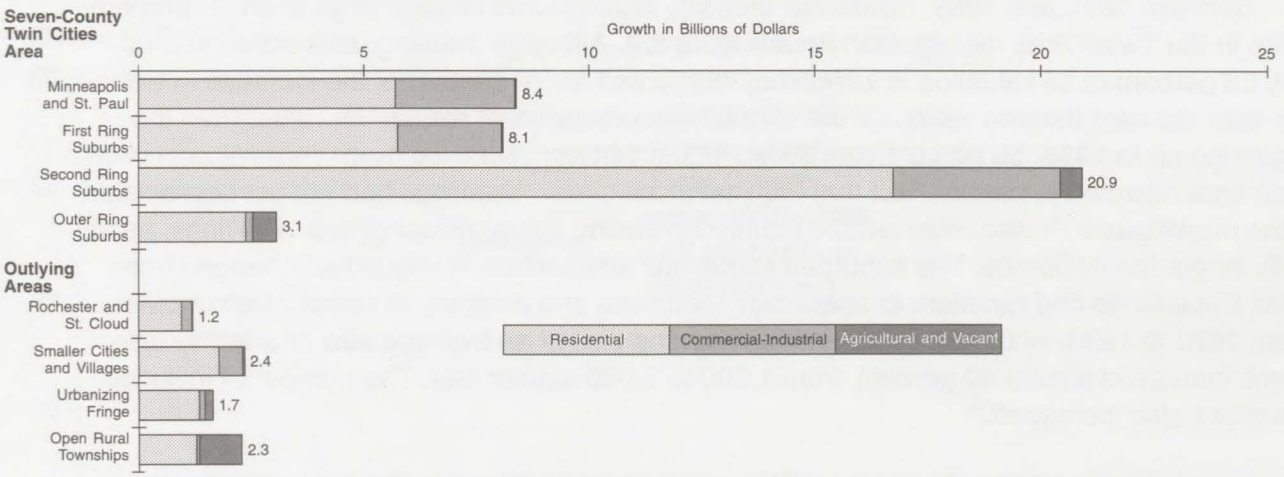
Figure 21 translates the growth into percentage terms. Percentage increase rates were comparatively low in the older central cities of the three metropolitan areas—Minneapolis–St. Paul, Rochester, and St. Cloud—and in the Twin Cities' first ring suburbs, where large absolute gains occurred on an even larger absolute base. The same relationship was evident on a lesser scale in the smaller cities and villages of the outlying counties. At the other extreme, phenomenal growth occurred on a modest 1975 base in the Twin Cities second ring suburbs. A large increase was measured against a small base in the outer ring of suburbs and in the urbanizing fringe.

Figure 19. Growth of taxable property values by development density classes, 1975-1988. Note that in this and subsequent figures the development density classes from Figure 3 have been changed. Within the seven-county Twin Cities area, "Smaller Cities and Villages," "Urbanizing Fringe," and "Open Rural Townships" classes are merged into a single "Outer Ring Suburbs" class. (All amounts in 1988 dollars.)



Overall, property assets rose much faster than inflation-adjusted income, which increased about 25 percent during this period. Explaining the difference is neither an exact nor a wholly definitive process. One important element might be the general expansion of credit and the ability of developers to tap national and international capital and concentrate investment in a particular growth center at a particular time.

Figure 20. Growth of value in taxable land use classes within each density class, 1975-1988. (All amounts in 1988 dollars.)



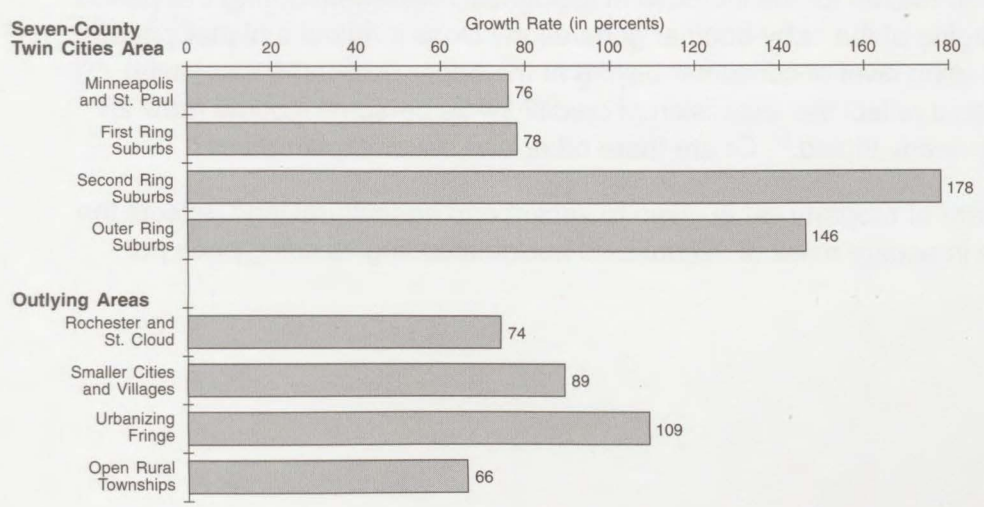


Figure 21. Growth in value of taxable property by density class, 1975-1988.

A Suburban and Residential Surge

For comparisons within the Twin Cities metropolitan area, better accuracy of data allowed us to include tax-exempt property along with residential, commerical–industrial, and agricultural and vacant properties (Figure 22). Close to half of the total gain occurred in the second ring suburbs. First ring suburban expansion accounted for about one quarter of the metropolitan area's growth. During the thirteen-year period the property value increase in the first and second ring suburbs, combined, equaled nearly three-fourths of the total value of the seven-county area up to 1975. The percents in Figure 22 reflect only part of the post-World War II building activity but emphasize the enormity of recent change. The result was a strong shift from the central cities and first ring suburbs to the second and outer suburban rings. The shift occurred despite heavy investment in office buildings both downtown and on the belt freeways of the first ring suburbs. Since the time of our latest data in 1988, the outward shift has probably accelerated because the value of many of those same office buildings has dropped sharply.[3]

Between 1975 and 1988, residential property increased its already large share of property value in the Twin Cities metropolitan area (Figure 23). Although dwelling units accounted for only 58 percent of all valuation in 1975, they accounted for 70 percent of the increase in valuation over the next thirteen years. Of the total net accumulation of residential value, from the beginning up to 1988, 55 percent was added in just thirteen years. So much new value in such a short time reflected in part the fact that the vast stock of new dwellings had not yet depreciated in the marketplace. It also reflected the rapidly increasing average cost of new dwellings, especially single-family homes. The suburban residential architecture in vogue had changed from small Cape Cods and ramblers to space-age Victorians and a variety of eclectic behemoths. From 1970 to 1990, while family size diminished, the size of an average new one-family residence increased almost 40 percent, from 1,500 to 2,080 square feet. The number of included amenities also increased.[4]

Figure 23 also shows the comparatively small share of growth in the non-residential sectors. While residential property assets grew by 121 percent in the thirteen years, commercial and industrial assets grew by 90 percent and tax-exempt assets by only 40 percent. Despite considerable and highly visible commercial and industrial construction—especially during the 1980s—that class gained only slightly in its overall share of the total property value.

One wonders about the reason for the increase in residential investment during this period. Does it simply reflect the aging of the baby-boomer generation? Does it reflect a higher priority for quality of life? An increasing level of consumer buying at the upper end of the residential price range? Or both? Does it reflect the expansion of credit? While personal income grew 25 percent, mortgage lending nearly tripled.[5] Or are there other and better explanations?

The decline in the share of property value given to vacant and agricultural land reflects the continuing gradual decline in square miles of vacant land notwithstanding its rising price per square mile.

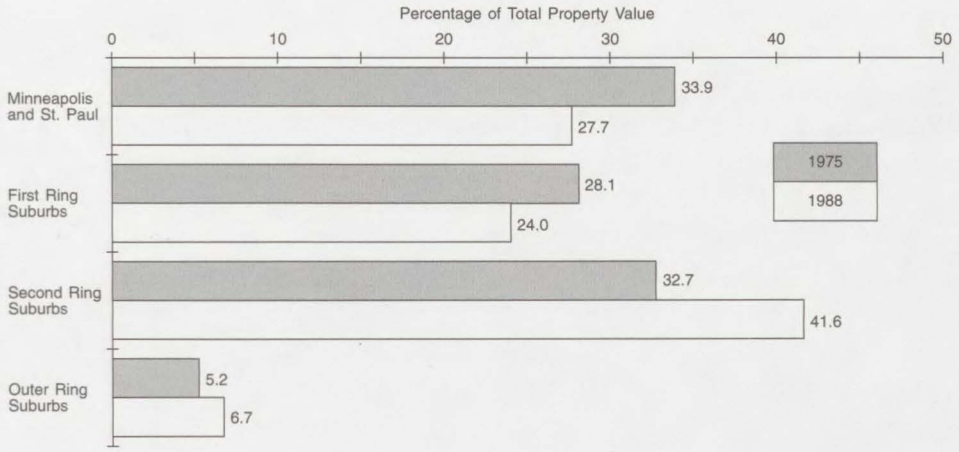


Figure 22. Shares of total property value among development density classes in the seven-county Twin Cities area, 1975 and 1988.

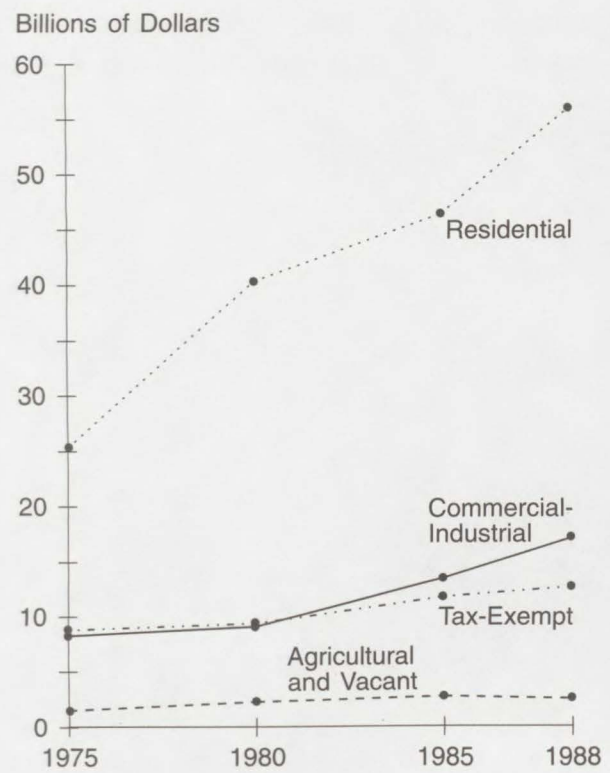


Figure 23. Property value change in the seven-county Twin Cities area, 1975-1988. (All amounts in 1988 dollars.)

Farm–Nonfarm Contrasts

Total estimated market value of taxable property in the outlying counties grew 81 percent between 1975 and 1988, compared with 115 percent in the seven-county Twin Cities area. But that figure masks disparities between different land use classes (Figure 24). Residential property value increased 117 percent, slightly less than the seven-county rate—reflecting partly slower economic growth and partly a smaller average new-home size. Similar to the seven-county area, 72 percent of the total property value increase in the outlying counties was in the residential class. Outlying commerical–industrial property value increased 63 percent, substantially below the rate of similar new investment in the Twin Cities area. This probably reflects the absence of monumental office construction and more modest industrial construction styles in the outlying counties.

But the dramatic feature of Figure 24 is the roller-coaster in agricultural land values. They nearly doubled between 1975 and 1980 but had fallen 31 percent by 1988, and subsequently they have lost most of the rest of the earlier gain.[6] Between 1985 and 1988, estimated market value of vacant and agricultural land fell by 25 percent in the outlying counties, while it rose typically between 8 and 15 percent in the seven-county real estate market around the Twin Cities. The rise and fall reflected the wave of speculation that followed the increase in crop prices triggered by the United States-Soviet grain agreement in the early 1970s and the subsequent collapse of the boom a decade later.

Houses hidden in the woods and scattered on the edges of pastures added $25 million to property value in this township along the interstate freeway west of St. Cloud.

Figure 25 summarizes the changes. Showing the increase in property value for all eight density classes and three of the land use classes, it displays the continuing heavy concentration of value in Minneapolis–St. Paul and the suburban rings, especially the second ring, during the

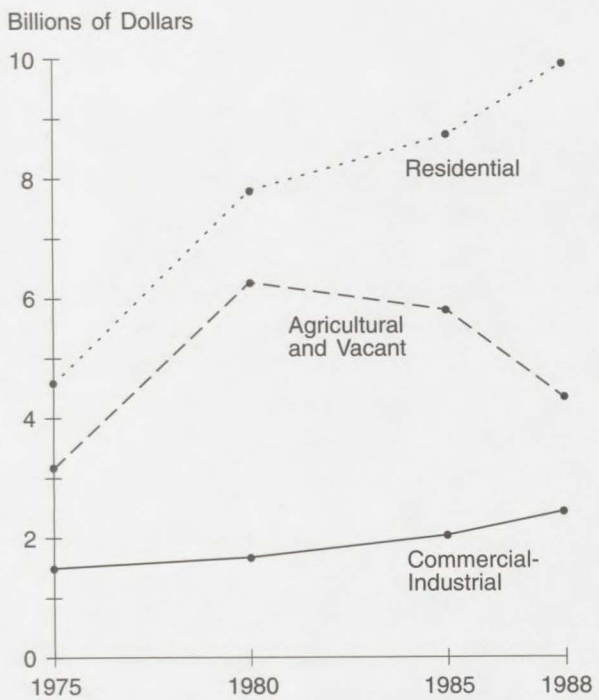


Figure 24. Property value change in the outlying counties, 1975-1988. (All amounts in 1988 dollars. Values do not include tax exempt property and public works.)

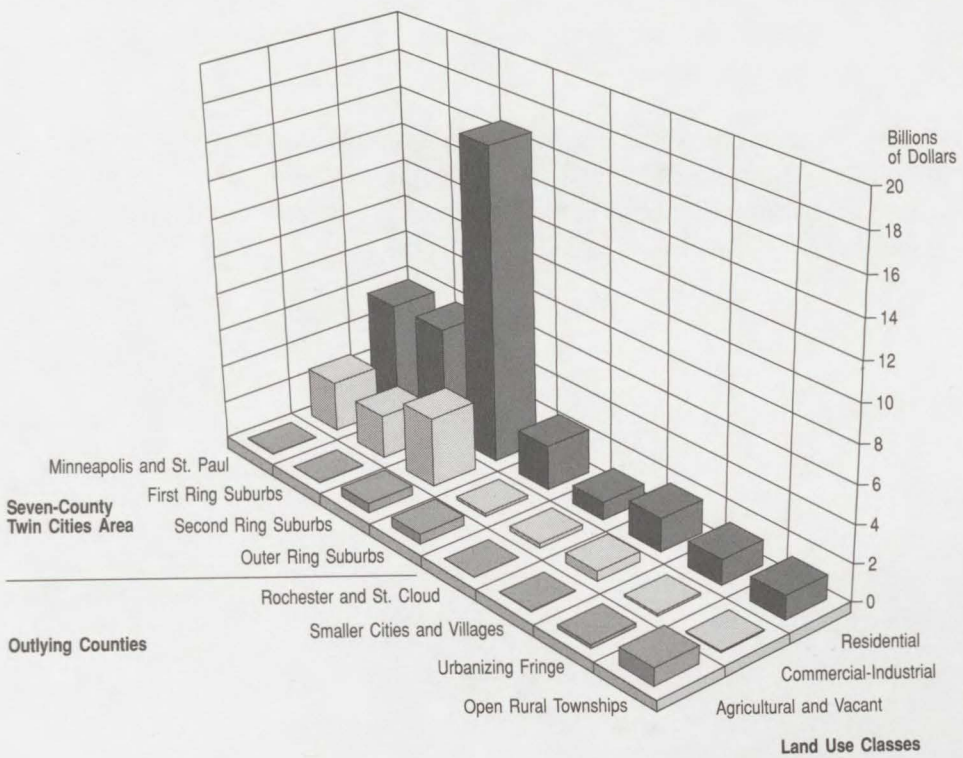


Figure 25. Increase in property value by development density and three land use classes, 1975-1988.

thirteen-year period. One can see the significant spread of residential development to the small cities and villages and to the countryside of the outlying counties. The two main concentrations of agricultural and vacant land value are in the ring of urban land speculation on the edges of the Twin Cities and in the rural, predominantly farming, townships on the edges of the region.

Local Surge Compared with National Trends

The St. Cloud–Twin Cities–Rochester corridor showed strong growth in its share of national property values. Even allowing for the widespread under-assessment of earlier years, the region's share grew from 1.12 percent in 1975 to 1.23 percent in 1985 to 1.39 percent in 1988 (Figure 26).[7] The share of real property assets increased significantly, while population remained almost static. We might expect the region's share to have grown no faster than its share of population, or perhaps less. The Upper Midwest has less historical momentum than the Northeast, a smaller share of the nation's capital-intensive industry compared with more populous markets and energy-rich areas, a smaller share of massive public works compared with the West, and fewer new structures compared with parts of the faster-growing West and South. Of course, the data could reflect speculation, or perhaps simply shortcomings in the numbers themselves. Better understanding awaits more and better nation-wide data.

We selected the years 1985 through 1988 in the seven-county Twin Cities area for further analysis. Though the period is very short, both the period and the area give us the highest accuracy in local estimated market values.[8] Estimated growth of all real property assets, including public works, was $19.6 billion in the seven-county area. The comparable national increase in the same period was $708 billion (all figures in 1988 dollars). Thus, with 1.2 percent of the nation's estimated property value in 1985, the Twin Cities area apparently was the focus of 2.8 percent of the national growth. Both residential and commerical–industrial growth in this region exceeded the national rates—which of course include all areas in the nation, not just the prosperous metropolitan areas. The Twin Cities appeared to increase its share of the nation's real property value very rapidly. How did this happen?

It is clear that the increase was not a statistical aberration due simply to raising assessed values relative to real market values. The ratio of assessments to market value during the three-year period was virtually constant.[9] What is not clear is how much of the surge reflected new investment in structures and how much just reflected speculation.

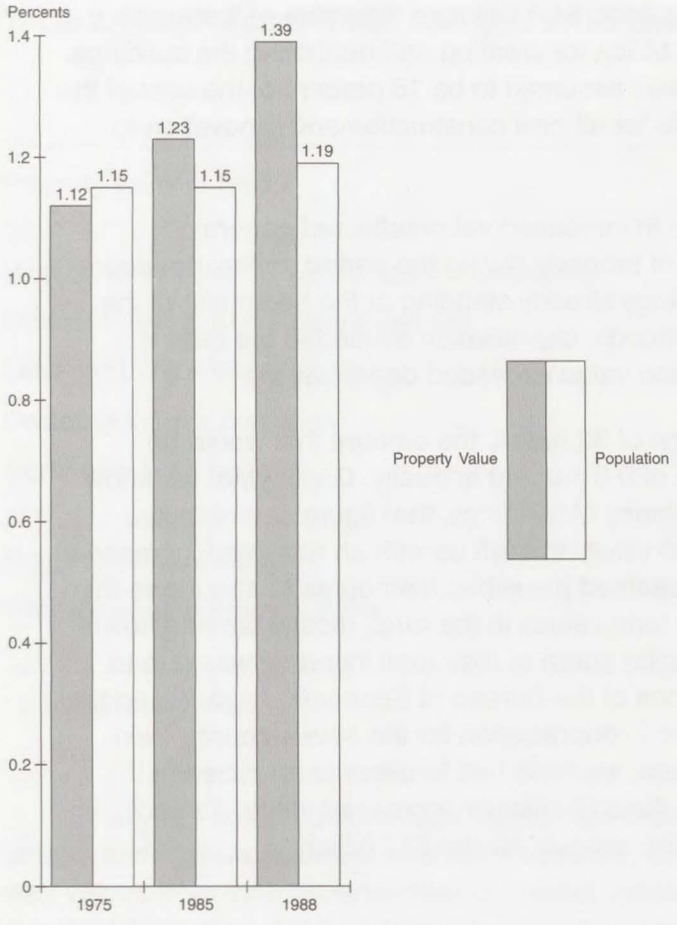


Figure 26. Share of United States property value and population within the St. Cloud–Twin Cities–Rochester corridor, 1975-1988.

The Composition of Change: A Ten Billion Dollar Question

From 1985 through 1988 the estimated market value of all buildings and their associated land in the seven-county Twin Cities area rose by $17 billion (excluding public works). How do we account for the increased value? The value of new construction is a good place to begin. The value of all permits for new building construction and remodeling totaled $7 billion from 1985 through 1988.[10] This leaves $10 billion of the increased value still unaccounted for. What items can we find to account for the rest? Here is a ten billion dollar question.

To close the statistical gap, we first estimated that actual land and building costs accounted for $13.6 billion of the total $17 billion in new market value. The estimate included costs for the new buildings which are typically not reflected in building permits—such things as unexpected additional labor and materials, engineering and design, interim financing, marketing, and profit. To reach this estimate we turned to the United States Census survey data. The Census publishes annual estimates of both the value of building permits issued in the country and estimates of the value of all structures put in place.[11] In making value of structures estimates it includes not only the value of materials and labor but also the other costs noted above. These estimates are 68 percent higher than the reported building permit values.[12] Applying the same

percentage to the seven-county Twin Cities area adds $4.8 billion to the value of the area's building permits, bringing the total cost to $11.8 billion for creating and marketing the buildings. The cost of buying and improving the raw land was assumed to be 15 percent of the cost of the buildings, or $1.8 billion.[13] This brings the figure for all new construction and renovation to $13.6 billion.

We assumed that the remaining $3.4 billion in increased value reflected general metropolitan-wide net gain in the location value of property during the period, minus net depreciation, due to aging and obsolescence, of buildings already standing at the beginning of the period. For some properties and some neighborhoods, depreciation exceeded the gain in location value; for most, however, gains in location value exceeded depreciation.

We next assumed a net over-all depreciation of $2 billion, the amount that would be attained by a 125-year straight-line depreciation of 0.8 percent annually. Given what we know about average replacement rates and life expectancy of buildings, that figure seemed plausible.[14] To complete the $17 billion in increased value, this left us with an assumed increase in location value of $5.4 billion. That amount also seemed plausible. It amounts to about one-third of the total gain. Comparison with the change in land values in the rural, mostly farming, townships in the outlying counties indicates that a similar share of their total increase was due to location value. Using the depreciation assumptions of the Bureau of Economic Analysis, on the other hand, we would have calculated $4.4 billion in depreciation for the seven-county Twin Cities area during the same period.[15] In that case, we have had to assume an increase in general location value of $7.8 billion to make up the $17 billion in increased value. Table 2 summarizes the calculations we made in trying the account for the $17 billion.

Uncertainties in Data and Interpretation

Although the proposed calculations in Table 2 account reasonably for the seven-county growth in estimated market value, they surely must be viewed with caution. We used the U.S. Census "Value of All Structures Put in Place" to adjust the actual building permit value upward, to cover the estimated additional costs of producing new buildings at a fair profit. But the basic census figures themselves can be questioned. The national Bureau of Economic Analysis (BEA) estimated the increase in value of all structures from 1985 to 1988, and its estimate is 68 percent higher than the comparable Census Bureau figure for new structures during the same period. The reason for the difference is the extent to which the BEA analysts believe the census data undervalues the cost of materials and labor.[16] So our adjustment, like the data on which it rests, could be off the mark by as much as 68 percent!

There are other cautions. For example, there is evidence, in comparing the various statistical series, that the building permit observations for the Twin Cities seven-county area are more complete than the national coverage. Furthermore, comparisons of Twin Cities assessors' values with the national series are hampered by the fact that the local data include the value of land, while national data do not. Consequently, it is necessary to delete land value from the local data or add land value to the national series before they can be compared. Although we made those adjustments, the business of estimating land value, either to subtract it or to add it, is fraught with problems.

Table 2. How Property Value Changed in the Seven-County Twin Cities Area, 1985-1988*

	With Higher Depreciation	With Lower Depreciation
Property Value in 1985	95.4	95.4
Value of Permits for New Building and Remodeling	7.0	7.0
Other Building and Marketing Expenses	4.8	4.8
Land and Land Preparation Costs	1.8	1.8
Decrease from Depreciation	-2.0	-4.4
Increase in Location Value	5.4	7.8
Property Value in 1988	112.4	112.4
Total Increase in Property Value	17.0	17.0

* In billions of 1988 dollars.

Finally, as noted earlier in this report, assessors' records do not include public works—streets and highways, sewer and water systems, airports. We had to estimate street and highway values from data on lane-miles of various types of surface, and we had to obtain the other numbers from separate and quite inconsistent public records. The task remains of developing estimates of the value of state and local public works which are comparable to assessors' records, on the one hand, and that are comparable to national estimates of value for government structures, on the other.

Perhaps the most interesting uncertainty in the data lies in our estimate of the general increase in location value. General location value does increase in a metropolis like the Twin Cities—whose population, wealth, and physical plant are growing—simply as a function of the area's accessibility to an enlarging market. However, while some of that growth is undoubtedly real, an unmeasured and unmeasurable portion reflects speculation.

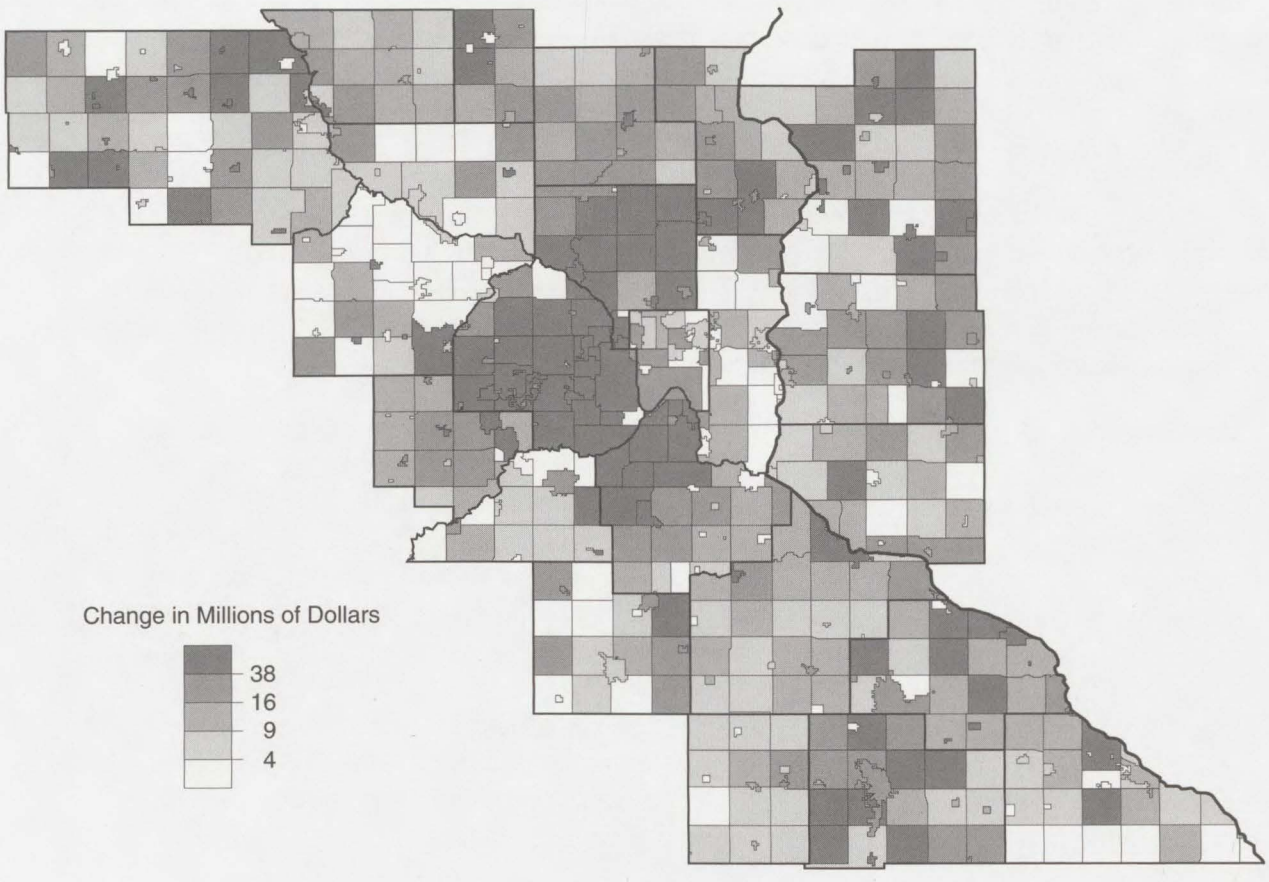
Most, if not all, developers are betting on their interpretations of income and population trends, direction and rate of expansion, the likelihood that buyers or tenants will share their interpretations, and the chance that users actually will be able to capitalize on the location and amortize the structures. Those bets were built into the varying values of accessible, improved farmland in the outlying counties in the 1970s. They were also built into the office-building component of the commerical–industrial land value increase in the 1980s. Since 1988—the last year of our data—much new office space has lost market value as precipitously as farmland value eroded in the early and mid-1980s. Considering the importance of the "increase in location value" factor in Table 2, one could argue that speculation about location value could have accounted for one-third or more of the increase in market value from 1985 through 1988. Of course, that also signals a warning that speculation was accounting for an equal share of the tax-base increase in which local governments were basking at that time.

The Path Ahead

In a recent *CURA Reporter* article, William Craig described the rapid evolution of computerized geographic area land information systems in Minnesota and in other states.[17] These systems are incorporating virtually the full range of public records, with the ability to map them, overlay those maps, and compare patterns both graphically and statistically. The impact of this technology is potentially profound. Arguably, it could ultimately represent a break-through in geography, history, and the social sciences that is comparable to modern developments in the biological and physical sciences. Meanwhile, Craig notes remarkable—though still more or less embryonic—applications in the management of law-enforcement, welfare, public improvements maintenance and planning, land use monitoring and planning, and land surveys. In the private sector, applications are well advanced in land development and property management, and particularly in the geographical aspects of marketing and utilities.

Assessors' estimates of the market value of real property are an important part of the data going into these systems (Figure 27). The automation of both data handling and mapping has already resulted in improvements in the accuracy and availability of the records, and it promises much more on those counts. To be sure, there is much to be done before the promise can be realized. Some tasks are as elemental as identifying parcels by their location in the original

Figure 27. A computer-generated map of change in taxable property value by city and township, 1975-1988. (All amounts in 1988 dollars.)



Public Land Survey. For example, in most of the counties of Minnesota and in the United States as a whole, we could not have summarized land value and land use data for aggregations of the one mile square, land survey sections, as we did in comparing the directional growth sectors of the Twin Cities (Chapter 2). The necessary data simply are not available. In Minnesota, counties do not report parcel counts and acreages to the state. Tax-exempt property is assessed less often and less rigorously than taxable property; hence the two are hard to compare although the distinction between them when one is analyzing many aspects of development is of little consequence. We hope that the state departments of revenue will come to require uniform reporting of these data from the counties, that they will summarize the data in a geographical and historical framework (along lines suggested by this study), and even that they will publish the summaries.

It will be even more difficult to generate data on the value of public works which are statewide and comparable to local assessors' estimates of market value. The Minnesota Department of Transportation maintains a remarkably detailed data base on the street and road network. An official, stable procedure for reckoning costs—including land and depreciation—could result in a body of street and road data that could be integrated with assessors' values for local areas. For sewer and water systems, the files suggest that methods of treating cost and depreciation vary widely, and that reporting from smaller places is both spotty and unreliable.

Which public agent would be the logical one to work on standardizing and summarizing the records on non-building structures? Perhaps the agency most concerned with monitoring the public's physical infrastructure, forecasting future needs, and coordinating expenditures. To our knowledge that agency is not yet identified, not designated, and not supported—in Minnesota or elsewhere.

Conclusion

Notwithstanding incredibly large and complex organizational problems, a standardized nationwide network of property value data will inevitably emerge. It will be possible to build national land use and land value data at every level aggregated from local records. Besides the value of this system at the state and local levels, it will be useful for the national balance sheet and system of accounts. The new technology and the system that will emerge with it will help narrow the range of speculation and error in documenting and understanding the complex processes of land development.

Property value records are a remarkable set of data. They record through time and over space the oscillating terrain of land use and value both public and private for the local, state, and the national scene. They have great current importance, and potentially greater future importance, for use in property accounting and planning. Moreover, property records are also a rare, if not unique, set of data for describing the nation's settlement system in comparable terms at every scale. The records can be aggregated from individual households to store fronts to skyscrapers to cities to the nation as a whole; from city lot to woodlot to field to ranch to region to nation. And the descriptions are always in the same measurement units. Thus, assessors' observations provide the basis for better mutual understanding of community management problems among public officials, taxpayers, builders, and occupants. They also help more of us, more of the time, to understand the outstanding variety of structures on the land as a vast, fragile device that the human race builds and rebuilds in order to live on earth.

Notes

Chapter 1

1. For detailed, long-term annual estimates, with an explanation of assumptions and methods, see *Fixed Reproducible Tangible Wealth in the United States, 1925-89*, Washington: U.S. Department of Commerce, Bureau of Economic Analysis, 1993. Brief summaries appear under the same title, as a table in the annual *Statistical Abstract of the United States*, Washington, U.S. Dept. of Commerce, Bureau of the Census.

2. Personal communication, Heather Quick, U.S. Bureau of Economic Analysis, 1993.

3. See 1982 Census of Governments, Series GC82(2), *Taxable Property Values and Assessment/Sales Price Ratios*, Washington: U.S. Bureau of the Census, 1984.

4. Comparative data on personal income and population from 1990 U.S. Census. Comparative data for U.S. property values from *Statistical Abstract of the United States (SAUS) 1991*, Table 762 and *SAUS 1987*, Table 754. The numbers are net values of all structures, including buildings and non-building structures; the referenced tables show total values and also sub-totals for private residential, private non-residential, and government structures. Net value is based on the value of the gross stock (the accumulated investment in new structures minus the accumulated value of structures which have been abandoned), minus the accumulated depreciation on the gross stock. (See *Fixed Reproducible Tangible Wealth in the United States*, referenced in note #1, above.) The annual summary tables in SAUS show both gross and net values for total fixed tangible reproducible assets. The tables also include a breakdown for structures only and for three major use-ownership classes. However, those details are shown for only gross values from 1985 onward, and for only net values for 1985 and earlier years. Therefore we calculated the net/gross ratios for each class of structures for 1985 and applied the ratio to 1975 and 1988 gross values to determine the net values for those years. That procedure is acceptable, since the overall net/gross ratio is a very stable number, approximately .0608, from year to year. Values for different years were converted to constant 1988 dollars using the GNP Implicit Price Deflator (*SAUS 1991*, Table 767). National land values were available for the years 1960, 1965, and 1968 from the *Statistical Abstract of the United States 1974* (*SAUS 1974*), Table 652, and for 1974 and 1975 from *SAUS 1978*, Table 777. We calculated the value of land as a percentage of the net value of structures for those years. The mean percentage was 21.4, with a mean deviation of 0.4. In calculating that ratio, we used the portion of national value attributed to private non-farm land plus 2 percent of the value of public land. We excluded farm land and national and state public land because those classes account for a much larger share of land value for the U.S. as a whole than for metropolitan regions such as our study area. On the other hand, local government public land value is concentrated within metropolitan reg- ions such as our study area and accounts for approximately 2 percent of national public land value.

   In the tables of *Fixed Reproducible Tangible Wealth in the United States,* values apply on December 31 of each year; while our values generally apply in January of each

year. Therefore our national and local figures are not strictly comparable. However, the discrepancy has no significant effect on the analysis. For example, if we used 1987 United States data instead of 1988, our study area property value as a percentage of the United States would be raised by a negligible 0.02 percentage point.

5. Values of streets and roads were estimated as follows. The Minnesota Department of Transportation (MNDOT) provided the number of lane-miles of all public roads and streets, in each of nineteen classes of surfacing, for each Minor Civil Division (MCD) in the study area. We combined those nineteen classes into three: gravel or unsurfaced, black-top, and concrete or equivalent. The Department also provided data which permitted the calculation of average 1988 replacement costs per lane-mile for seven different functional classes of road for rural and urban areas. The seven functional classes were combined into three, and those were matched with the three surface classes. Finally, we used the department's twenty-year line depreciation formula and assumed that the average age of road was ten years (half way from new to the time for major resurfacing or replacement). Thus the value of roads in each MCD for each type was calculated to equal 50 percent of the 1988 replacement value per lane mile multiplied by the number of lane-miles. The resulting values ranged from $35,000 to $2 million per lane-mile in urban and suburban MCDs, and $30,000 to $525,000 per lane-mile in "open" MCDs, with the top values doubled for the federal interstate system. Allowance was not made for the expansion of population and settlement in the past decade. For that reason, the value is understated by the order of perhaps 10 percent. Finally, the estimated value of roads was multiplied by 1.325 to account for the value of the land in the rights-of-way. The land multiplier is based upon a Minnesota Department of Revenue calculation that land currently accounts for an average of 24.5 percent of real property value. That agrees closely with the U.S. figure, averaged for the years of published estimates 1952-75 (see note #4).

   Value of sewer and water systems are "net depreciated value" in the annual reports of municipalities, in the files of the Minnesota State Auditor. The methods of calculating depreciation are not uniform among municipalities, and some smaller places consistently fail to report. The net result appears to be a considerable, but unknown, understatement of the value of these properties. The data were assembled from the files by Jack Byers, University of Minnesota geography department, with the assistance of the Minnesota Auditor's office.

   Estimated market values of tax-exempt buildings are not available for Wisconsin communities, and highway mileage figures were not obtained from Wisconsin. Instead, those numbers were estimated using ratios from Minnesota areas deemed analogous. The assessors' estimates for tax-exempt land in Minnesota are less reliable than the estimates for taxable property. The tax-exempt data were missing for some MCDs, and they appeared to contain inconsistencies due to local practices.

6. The first and second ring suburbs are classified on the basis of assessed value per square mile in 1988. Therefore the places within those classes differ somewhat from the familiar first and second rings used in the publications of the Twin Cities Metropolitan Council.

   The first ring includes the following municipalities: Bloomington, Brooklyn Center, Columbia Heights, Crystal, Edina, Falcon Heights, Golden Valley, Hilltop, Hopkins, New Brighton, New Hope, Richfield, Robbinsdale, Roseville, St. Anthony, St. Louis Park, West St. Paul.

The second ring includes: Anoka, Arden Hills, Apple Valley, Birchwood Village, Blaine, Brooklyn Park, Burnsville, Chanhassen, Champlin, Chaska, Circle Pines, Coon Rapids, Cottage Grove, Deephaven, Dellwood, Eagan, Eden Prairie, Excelsior, Farmington, Fridley, Gem Lake, Greenwood, Inver Grove Heights, Lake Elmo, Lakeville, Lexington, Lilydale, Little Canada, Long Lake, Mahtomedi, Maple Grove, Maplewood, Mendota, Mendota Heights, Minnetonka, Minnetonka Beach, Mound, Mounds View, Newport, North Oaks, North St. Paul, Oakdale, Orono, Osseo, Pine Springs, Plymouth, Prior Lake, St. Paul Park, Savage, Shakopee, Shoreview, Shorewood, South St. Paul, Spring Lake Park, Spring Park, Sunfish Lake, Tonka Bay, Vadnais Heights, Victoria, Wayzata, White Bear Lake, Willernie, Woodbury, and Woodland.

7. We excluded public works and vacant and agricultural lands from this calculation. Recent economic research has indicated that investment in household capital exceeds investment in business capital and "...comes up with figures ranging between 20 and 50 percent of the value of measured gross national product..." for the value of household output. Jeremy Greenwood, Richard Rogerson, and Randall Wright, "Putting Home Economics into Macroeconomics," *Quarterly Review*, Federal Reserve Bank of Minneapolis, Summer 1993, pp. 2-11.

8. See note #4 on comparative United States data for private residential, private non-residential, and government structures and estimates of value of associated land. In comparing our local valuations with national, we assumed that the local assessors' "tax-exempt" class of property would be in the BEA "private, non-residential" category, and that our "public works" class would be equivalent to the BEA "government" category.

9. Minnesota industry is characterized by a higher value added per production employee and a higher proportion of office and laboratory employees than the nation as a whole; it lacks very highly capitalized metallurgical, petrochemical, and heavy machinery and metal-working industries (*Statistical Abstract of the U.S. 1991*, Tables 668, 1305).

Chapter 2

1. The technical term for what we have called "general regional accessibility" is "population potential." For an explanation and an illustration of the application of this concept, see John R. Borchert, *Projection of Population and Highway Traffic in Minnesota*, Minnesota Highway Research Project, Department of Agricultural Economics and Department of Geography, University of Minnesota, 1963.

2. These sections have their origins in the original Public Land Survey. The base map reproduced comes from: Ronald Abler, John S. Adams, and John R. Borchert, *The Twin Cities of St. Paul and Minneapolis*, Cambridge, Mass.: Ballinger Publishing Co., 1976, Figure 10, p. 24.

3. The southwest and south suburbs in the first ring include Golden Valley, St. Louis Park, Edina, Richfield, and Bloomington. The southwest suburbs in the second ring include Minnetonka, Eden Prairie, and Hopkins.

Chapter 3

1. All numbers in this figure are in constant 1988 dollars, adjusted for inflation using the Producer Price Index. However, we did not correct the data for changes in the Minnesota Department of Revenue's assessment to sales ratio—the assessors' estimated market values divided by the prices paid for property sold (A/S). Over the period 1975-88, the A/S ratios have risen as the assessed values have become increasingly accurate. The increase in weighted average A/S ratio for the twenty-three-county area probably accounted for about one-eighth of the increase in estimated market value from 1975 to 1988.

2. Tax-exempt property and public works are omitted from the $48 billion because of inconsistencies among estimates for different large cities and lack of public works estimates for the years before 1988.

3. The press has reported estimates of a drop of one-third to one-half in the value of first-class office property. Sale prices of properties were as low as 10 percent and 1 percent of their original cost in two cases. Samples of the reports are: Eric Weiffering, "Is the Party Over? Falling Tax Values Threaten Metro Governments," *The Region*, Federal Reserve Bank of Minneapolis, February 1991, pp. 5-9; Patricia Lopez Baden, "City's huge deficit could mean higher homeowners taxes," *Star Tribune*, July 13, 1993, p. 1, ff.; Susan Feyder, "Financial Firm Leaving Edina for Downtown Minneapolis," *Star Tribune*, July 29, 1993, p. 1B, ff.; Allen Short, "Whitney block is yet another monument to bad timing," *Star Tribune*, October 31, 1993, p. 11A; Jennifer Waters, "Jacobs plots center's revamp," *CityBusiness*, November 26, 1993, p. 3.

4. *Statistical Abstract of the U.S. 1991*, Tables 1267 (permit values) and 1271 (dwelling unit characteristics).

5. Mortgage debt rose from $0.8 trillion to $2.2 trillion (1988 dollars) between 1970 and 1988 (*Statistical Abstract of the U.S. 1991*, Table 798); values converted to 1988 dollars using the GNP Implicit Price Index).

6. For detailed description and analysis of these fluctuations, see Philip M. Raup and various co-authors, *The Minnesota Rural Real Estate Market (annually)*, St. Paul: University of Minnesota, Department of Agricultural and Applied Economics.

7. Comparative property values for the United States are taken from the sources cited in Chapter 1, footnote 5, and adjusted using the data and assumptions noted there. We use national "net" values, which we have expressed in constant 1988 dollars and adjusted upward to include the estimated value of both structures and associated land.

8. A general but variable reduction in Minnesota Revenue Department assessment to sales (A/S) ratios meant that A/S corrections of our 1975, 1980, and 1985 data would have actually reduced comparability among those years.

9. The weighted A/S ratio for the seven-county area was almost unchanged between 1985 and 1988, approximately 0.89.

10. Twin Cities Metropolitan Council Data Center, unpublished compilations from United States Census reports, courtesy of Regan Carlson.

11. *Value of New Construction Put in Place May 1991*, Current Construction Report C30-9105, Washington: United States Bureau of the Census 1991, Appendix A.

12. We used the F.W. Dodge reports of "construction contracts let" as an estimate of building permit value, in preference to the Census "building permit" figures, because we feel the Dodge reports have better national coverage. Reported contracts let for buildings (non-building structures excluded) totaled about $639 billion for 1985-88, while Census reported building permit total was $585 billion. The Census "value of new construction put in place" (buildings only) for 1985-88 was approximately $1,085 billion, or 1.68 times the "building construction contracts let."

13. Ned Eichler, *The Merchant Builder*, Cambridge: MIT Press, 1982, pp. 20, 49.

14. Over the past three decades, life expectancy of an average new dwelling unit has been near 125 years. The number of new dwelling units produced each decade by the construction industry is different from the number of new households formed in the society. We assume that the supply of new units produced must first be used to meet the demand from new household formations. Any dwelling units produced in excess of that demand may be used to replace worn-out or obsolete existing housing units. Thus, those new units represent *replacement* construction. They are available to replace old units after the demand of new growth has been met. The number of replacement units determines the number of units which may then be abandoned to either decay or demolition. The *decennial replacement rate* may be expressed as the number of replacement units built during the decade, divided by the number of households in existence at the beginning of the decade. Or that quotient may be expressed as a percentage. The decennial replacement rate for the 1980s was 6.6 percent. At 6.6 percent per decade, fifteen decades, or 150 years, would be needed to replace 100 percent of the stock. Since World War II the nation's housing replacement rate has ranged from a high of 13.7 percent in the 1950s to a low of 6.3 percent in the 1970s. At those rates, the entire stock could be replaced in 73 to 160 years. You can see that our 125-year assumed life-of-buildings falls near the middle of this range of historical experience. New housing production includes mobile homes. (Data from *Statistical Abstract of the United States 1991*, Tables 62, 1,269, and 1,274; *SAUS 1981*, Tables 63 and 1,365; *SAUS 1962*, Tables 38, 1,062, and 1,064; and *SAUS 1959*, Table 1,020.) For longer-term historical perspective see John R. Borchert, "Futures of American Cities" in John Fraser Hart (ed.), *Our Changing Cities*, Baltimore: The Johns Hopkins University Press, 1990, pp. 218-250; and John R. Borchert, Earl E. Stewart, and Sherman S. Hasbrouck, *Urban Renewal Needs and Opportunities in the Upper Midwest*, Minneapolis: Upper Midwest Economic Study (University of Minnesota), 1963.

15. Using average service lives for residential and non-residential buildings from the United States Bureau of Economic Analysis (BEA) tables, we calculated a straight-line depreciation rate of 1.53 percent per year, or 4.6 percent in three years. Given $95.4 billion property value in 1985, the resulting three-year depreciation would have been $4.4 billion. For a careful discussion of the BEA method of estimating depreciation, see "Fixed Reproducible Tangible Wealth in the United States," cited in Chapter 1, footnote 1, pp. M-16 to M-19.

16. Personal communication, John C. Musgrave, U.S. Bureau of Economic Analysis, 1993.

17. William J. Craig, "The Rising Tide of GIS," *CURA Reporter*, May, 1993, pp. 6-11.

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